UNIVERSITY of GUELPH

OFFICE of RESEARCH
AGRI-FOOD PARTNERSHIP

OMAFRA-UofG Agreement Consolidated Annual Report Year 4, 2021/22

Version 4

December 14, 2022

Office of Research Agri-Food Partnership
University of Guelph

UNIVERSITY of GUELPH

OFFICE *of* THE
VICE-PRESIDENT RESEARCH

December 13, 2022

Mr. Gregory Wootton
Assistant Deputy Minister
Research and Corporate Services Division
Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)
1 Stone Road, 2nd Floor NW
Guelph, Ontario N1G 4Y2

Re: 2021/22 OMAFRA-UofG Agreement Consolidated Annual Report

Dear Assistant Deputy Minister Wootton,

On November 14, 2022, the Ontario Agri-Food Innovation Alliance Agreement Leadership Committee approved the 2021/22 OMAFRA-UofG Agreement Consolidated Annual Report. I am pleased to confirm that the University of Guelph has complied with all material provisions of the 2018-23 Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)-University of Guelph (UofG) Agreement and is managing any Funds provided under this Agreement effectively and efficiently and with due regard to obtaining appropriate value for money expended.

The Alliance is proof that the UofG can leverage cutting-edge research and innovation to support the goals and prosperity of all Ontario communities and industries.

All the best,

Malcolm Campbell

Malcolm M. Campbell, PhD
Vice-President (Research)

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1 INTRODUCTION

This Consolidated Annual Report is submitted to the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) in accordance with the terms and commitments under the OMAFRA-University of Guelph (UofG) Agreement. This is the fourth annual report under the Agreement that operates for the period of April 1, 2018 to March 31, 2023.

The University of Guelph has complied with all material provisions of the Agreement and managed the transfer payment funds provided under the Agreement effectively and efficiently, and with due regard to obtaining appropriate value for money expended.

The reporting period of this Annual Report is the UofG's 2021/22 fiscal year (May 1, 2021 to April 30, 2022). The report covers the activities, budgets, expenditures, and performance measures for each of the five program areas of the Agreement: the Research Program; the Veterinary Capacity Program (VCP); the Animal Health Laboratory (AHL); the Agriculture and Food Laboratory (AFL); and the Property Management Program.

After approval, this report will be posted at The Atrium, UofG's digital repository.

Economic Impact

The Ontario Agri-Food Innovation Alliance (the Alliance) is committed to improving the lives of Ontarians by enabling a competitive and sustainable agri-food sector—at home and around the world. Through the Alliance, the UofG and OMAFRA deliver novel research, laboratory capacity, property management and veterinary capacity programs to ensure Ontarians have access to healthy, safe food, and that Ontario's farms and businesses are innovative, competitive, and sustainable.

UofG commissioned Ernst & Young to measure the economic impact of the Alliance across Ontario and Canada as part of a broader assessment of the University's contributions to the province and the country. **The Alliance contributes $1.4B to Ontario's GDP annually and sustains 1,350 jobs in Ontario.** More details about how the Alliance delivers positive impacts for Ontario's agri-food sector and makes significant contributions to the provincial economy can be found on the University of Guelph's Economic Impact Report website under the Impact of the Ontario Agri-Food Innovation Alliance on the Ontario's Economy section.

Equity, Diversity, and Inclusion

As directed by the Agreement Leadership Committee and as part of OMAFRA's Anti-Racism Action Plan, the Alliance is committed to strengthening equity, diversity, and inclusion (EDI) in Alliance programming. To assist with this, the Alliance established the Alliance EDI Advisory Group in 2021/22 to develop an EDI statement and action plan for the next OMAFRA-UofG Agreement. Work by this group commenced in April 2022 and will continue until December 2022. To support this important work and other EDI initiatives in the Office of Research, the University hired Ms. Joanne Garcia-Moores as the Indigenization, Equity, Diversity, and Inclusion Advisor in Research. With guidance from the University's Diversity and Human Rights Office (DHR), Ms. Moore's knowledge, and the expertise available through OMAFRA, the Alliance is well prepared to undergo this important work.

Recently, the UofG was proud to be named among Canada's best employers for diversity, according to survey results released by Forbes magazine: Meet Canada's Best Employers For Diversity 2022. The UofG was ranked in the top six universities surveyed on the list of Canada's Best Employers for Diversity 2022. UofG also ranked among the top 50 employers overall for creating a welcoming environment for equity-seeking groups.

COVID-19

Unlike other Ontario universities that completely shut down research, the University of Guelph sustained substantial research activities during all phases of the COVID-19 pandemic. This reflects the province's identification of 'research' and 'agriculture and food' as essential activities. Since the beginning of the pandemic, hundreds of UofG research projects have been identified as critical and/or time-sensitive, enabling more than 400 faculty members to continue to pursue research.

Some 350 Office of Research staff, most employed as part of the OMAFRA-UofG Agreement, continued to work in place during all phases of the pandemic, running the substantial research facilities, as well as sustaining provincial testing that ensures Ontario's food supply is robust, safe, healthy, and nutritious, and that livestock and other animals are well-cared for.

This exceptional level of research-related activities sets the University of Guelph apart from other Ontario universities, and underscores its unique, research-intensive, impactful, real-world-relevant nature.

As the pandemic begins to wane, COVID-19-related mandates (e.g., the mask mandate and vaccination mandate) at the University have been paused, as have many of the public health measures that were limiting capacity and in-person interactions. However, the University stands ready to reintroduce or evolve measures as needed to address a resurgence of the virus. More details about the impact of COVID-19 on the Agreement are outlined in each of the Program sections.

1.1 Report Structure

The structure of the fourth Consolidated Annual Report is consistent with the two previous annual reports and reflects the order of the 2021/22 Business Plan. Section 1 is this Introduction. Section 2 is a Financial Summary and Analysis. Sections 3 through 7 are reports on each of the Agreement's Programs. These sections include highlights, updates, and performance information. Throughout the report, when numeric metrics are available, summary tables have been provided to display the metric over the term of the Agreement.

In addition to the formal Consolidated Annual Report, the University also produces *Growing Ontario Solutions,* which delivers a visual summary of how the programs are integrated and their outputs amplified to meet the Agreement's strategic objectives. The vision for this document is to reaffirm UofG's commitment to demonstrating how the Agreement delivers value for Ontario and how the UofG leverages the province's investment to make Ontario a global leader in agri-food innovation. *Growing Ontario Solutions 2021/22* will be available in September 2022.

1.2 About Us

The UofG and OMAFRA strive to be a world-renowned model of government-university collaboration. By working together, the UofG and OMAFRA enable the research, innovation, laboratory science, training, and infrastructure necessary to keep Ontario's agri-food sectors and rural communities vital, competitive, and

sustainable. Agri-food is one of Ontario's largest industries, worth $45 billion[1] to the province's economy and directly employing more than 723,000 people[2]. The agri-food sector is evolving and tasked with providing innovative solutions to a growing number of challenges, from producing more food while protecting the environment to making greater contributions to human health.

The University of Guelph is a natural leader in addressing these challenges. The long-standing partnership with OMAFRA, known as the Ontario Agri-Food Innovation Alliance, is fueled by a shared commitment to support the growth and prosperity of Ontario's agri-food sector and the vitality of rural communities. By working together, the Alliance has become more than an example of government-university collaboration; it is also producing *Ontario Solutions with Global Impact*.

1.3 Strategic Focus

The University of Guelph works with OMAFRA and partners to support the success of Ontario's agriculture, food, and bioproduct sectors. The University also focuses on supporting the vibrancy of rural communities, and the health and well-being of the province, its environment, and its citizens. The University's work includes:

- Advancing a world-class research and innovation system;
- Training the next generation of agri-food innovators;
- Developing a unique platform for collaboration and innovation;
- Creating a transparent agri-food sector you can trust;
- Establishing a safe and secure agri-food sector; and
- Constructing an enhanced system for research data access and storage.

As will be obvious from the report that follows this Introduction, the Alliance is a complex system of programs and activities, which proceed under joint governance, that delivers on its strategic focus for Ontario. This rich complexity of stakeholder engagement, field-scale and state-of-the-art platforms for research and surveillance, peer-reviewed research, and training of technical capacity, ensures that Alliance programming is relevant, timely and ultimately will result in benefit to all of Ontario. Without any one component of this research and innovation ecosystem, the delivery by the Alliance of value for Ontario's agri-food sector would be weakened.

[1] Agri-Food Industries, Ontario: 2007-2020 excel, "Ontario Gross Domestic Product (GDP) for Agri-Food Sector, 2007-2020 ($ million)", Ministry of Agriculture, Food and Rural Affairs, last modified April 13, 2022. http://www.omafra.gov.on.ca/english/stats/economy/index.html

[2] Agri-Food Industries, Ontario: 2007-2020 excel, " Employment in the Agri-food Sector, Ontario, 2007-2020", Ministry of Agriculture, Food and Rural Affairs, last modified April 13, 2022. http://www.omafra.gov.on.ca/english/stats/economy/index.html

1.4 Approach

The Alliance invests in the people, places, and programs that support the Agreement's strategic focus to strengthen Ontario's agriculture, food, bioproduct, and rural sectors for the benefit of Ontario and Ontarians. The University of Guelph administers and leverages this investment to make Ontario a global leader in agri-food innovation. It is making a difference across Ontario by achieving assurance in food safety, supporting a competitive and sustainable agri-food sector, and building healthier communities and a healthier environment.

1.5 Version Control and Approvals

This section outlines the changes that have been made in each version of the Consolidated Annual Report. It also highlights the approval dates as the report works its way through the governance processes.

Version 4

Approvals were noted in the version history. Letter from Vice-President (Research) was added. This Report was updated from Draft to Final.

Version 3

Approval by Alliance Leadership Committee on November 14, 2022

Submitted to the Research and Innovation Branch, OMAFRA on November 4, 2022

Review and approvals were noted in the version history. Section 7.4.1 University Tenants at ARIO Research Centres was updated to include the historical names of the locations.

Version 2

Approval by Executive Committee on October 21, 2022

Confirmation of Review by Coordinating Committee on October 20, 2022

Submitted to the Research and Innovation Branch, OMAFRA on October 7, 2022

Feedback was received by the Research and Innovation Branch (RIB) on August 24, 2022. The University made a number of minor changes based on the feedback which are described in the Excel spreadsheet labelled "Alliance 2122 Annual Report Review".

Version 1

Submitted to the Research and Innovation Branch, OMAFRA on July 29, 2022

This report was prepared and submitted to the Research and Innovation Branch of OMAFRA on July 29, 2022.

1.6 Communications

The people, places, and programs of the Ontario Agri-Food Innovation Alliance work together to deliver *Ontario Solutions with Global Impact*. As part of UofG's commitment to advancing the objectives of the Alliance, it builds and manages a series of communications vehicles and products to tell the story of the Alliance, its positive impacts, and contributions.

This new section of the Consolidated Annual Report is designed to provide an update on the communication products and vehicles that deliver cross-Program profile and impact, such as the Alliance newsletter, website, social media channels, and impact communication products. These vehicles and products are used by the respective Programs to achieve a variety of objectives but are united by their intent and design to promote the Alliance as a whole.

In 2021/22, communications and marketing activities continued to focus on digital platforms, which have become the most effective option since the start of COVID-19. Working collaboratively with partners across UofG and OMAFRA, the team delivered a variety of digital publications, and web and social media content to reach target audiences and increase awareness of how the Alliance invests in people, places, programs, and partnerships that return value to Ontarians.

1.6.1 Alliance Website

The Ontario Agri-Food Innovation Alliance website is designed to serve as a critical information resource for researchers, partners, and government funders. Office of Research staff work to populate the website with interactive communications assets to engage the broader agri-food community. This remains a priority for 2022/23.

In 2021/22, three significant updates were made to the Alliance website. The first update added two new webpages to ease information access for researchers interested in applying for Alliance funding. The second involved a reorganization of the main navigation menu and the implementation of the new “Our Impact” section to create a space for internal and external audiences to learn more about the long-term impact of Alliance programming. Finally, the third created a new website infrastructure for listing and accessing information on funded projects. While some of these updates relate to the research funding program, they are detailed here because they are significant feature of the Alliance website and help to promote the Alliance as a whole.

For researchers looking to access Alliance funding opportunities, two web pages were created to help guide researchers to relevant resources. These pages -- Ontario Agri-Food Innovation Alliance Research Programs - Apply for Funding webpage and Ontario Agri-Food Innovation Alliance Research Programs - Resources for Researchers webpage – provide quick, easy access to information relevant to researchers, both program applicants and funding recipients. Since their launch in December 2021, the “Apply for Funding” landing page has received 413 pageviews and the “Resources for Researchers” landing page has received 143 pageviews to support engagement with the research funding programs. These updates were part of a broader project to reorganize the content of the Alliance website to ease the user experience, making resources to support program delivery clear and easy to maneuver while creating space to highlight the impact of the Alliance.

The new Ontario Agri-Food Innovation Alliance Our Impact webpage created a critical space to highlight the impact of the Alliance as a whole, as well as its respective programs. The section has been populated with a host of new material, including impact case studies, annual reports, and publications that highlight the Alliance’s impact on Ontario’s agri-food sector. From its launch in December 2021 to April 30, 2022, the “Our Impact” section (including subsections) received 1,320 pageviews, which accounted for 3.5% of total website traffic from December 2021 to April 2022. This section plays several roles in the Alliance communications strategy, acting as both a resource for OMAFRA and other interested partners.

The third significant website update involved creating a new tagging platform to showcase Alliance-funded research projects. In the past, project summaries have been communicated as a designed or plain PDF posted on the Alliance website. In 2020/21, the list of funded projects was included directly on the Alliance webpage,

but this option made it difficult to find specific research projects or projects related to a keyword. Additionally, the team received feedback from industry partners indicating that it was difficult to find projects dedicated to specific OMAFRA priorities. This feedback was taken into consideration when designing the tagging system for the new platform. In March 2022, the new Ontario Agri-Food Innovation Alliance Research Programs - Funded Research Projects webpage was launched on the Alliance website and included the following enhanced user experience features:

- Visitors can now locate all the funded projects in one location on the Alliance website;
- Projects can be sorted based on four categories, including year, program type, research priority, and research centre; and
- Individually dedicated webpages for each research project that can be easily updated with project statuses.

From the launch in March to April 30, 2022, the new Funded Research Projects webpage received 1,328 pageviews, which is 8% of total website traffic from March to April 2022.

Table 1.1 highlights overall metrics for the Alliance website. Analytics demonstrate that both users (an individual who visits the website; note that this number does not count unique users, rather individuals are counted for each visit) and sessions (users who engage with the website by clicking through pages or downloading content) increased significantly between the 2020/21 and 2021/22. The reasons for this likely include the updates to the website that occurred during 2021/22.

The increase in users, sessions, and pageviews is diminished slightly by the increase in bounce rate, which is high for the website. The communications team will continue to work towards reducing the bounce rate over the next fiscal year, but it is worth noting that a high bounce rate can partially indicate that users are accessing the website via links or social media and finding the information they need quickly and easily, which is to be expected for a website focused on delivering specific information to program applicants.

Table 1.1: Metrics for Alliance Website

Metric	2020/21	2021/22	Percentage Change from Prev. Year
Users	20,209	26,957	33%
Sessions	34,280	40,979	19%
Pageviews	74,198	85,747	15%
Pages per Session	2.16	2.09	-3%
Avg. Session Duration (mins)	02:23	02:11	-5%
Bounce Rate[3]	57.21%	64.65%	13%

1.6.2 Alliance Innovations

Started in June 2020, *Alliance Innovations* is a monthly newsletter distributed to more than 750 contacts at the UofG and OMAFRA, as well as industry partners and the members of the public who have signed up to receive

[3] A bounce is a single-page session on the site. Bounce rate is single-page sessions divided by all sessions. If the success of the site depends on users viewing more than one page, then a high bounce rate is undesirable. However, if single-page sessions are expected, for example accessing funding call details, then a high bounce rate is normal.

it. The open rate has remained over 30% (31% for 2021/22), surpassing the overall industry average (supplied by the e-newsletter software company Constant Contact) of 29% and slightly below the industry average for higher education of 33%[4]. The average click rate is 7%, which is above the education industry average of 5%.

The team continues to strengthen and leverage relationships with campus partners such as the Ontario Agricultural College (OAC), Food from Thought, Arrell Food Institute, and others that have similar or overlapping audiences, content, and goals. In December 2021, the Alliance partnered with Food from Thought to announce the 2021/22 Highly Qualified Personnel (HQP) scholars through a joint newsletter campaign. The special edition joint newsletter featured the HQP Scholarship program which supports the development of highly skilled graduates who become future researchers, policymakers, business leaders and innovators to meet the changing demands of the agri-food and rural sector in Ontario and around the world. The program is jointly funded by the Alliance and Food from Thought. The HQP joint newsletter was the highest preforming newsletter for the 2021/22 year with an open rate of 35% and a click rate of 13%.

Other editions of *Alliance Innovations* have focused on the complete range of Alliance programming, ranging from Ontario's Agri-Food Research Centres to the Agriculture and Food Laboratory and Animal Health Laboratory. With consistent deployment over the last two years, the newsletter has become a useful tool for promoting events, programs, and research findings arising from Agreement funding.

1.6.3 Growing Ontario Solutions

The third edition of *Growing Ontario Solutions*, the communications summary of the OMAFRA-UofG Agreement Consolidated Annual Report was delivered in Fall 2021. A communications plan was developed that included promotion through *Alliance Innovations*, a dedicated Microsoft Sway webpage, and a social media campaign consisting of 12 posts. The Alliance was asked by OMAFRA in February 2022 to pause implementation of the promotion plan for *Growing Ontario Solutions* 2020/21. As noted in the following section on social media, the pause in promotion likely negatively impacted the Alliance's overall performance on social media channels.

1.6.4 Program Impact Case Study Series

Following the positive feedback received for the Research Impact Case Study series, the team developed an additional complementary series that featured three Alliance Programs—the Animal Health Laboratory (AHL), the Agriculture and Food Laboratory (AFL), and the Veterinary Capacity Program (VCP). This series demonstrates how the Alliance supports laboratory services that provide comprehensive, reliable, accredited testing services, and veterinary training for the benefit of the agri-food sector and rural communities.

The Program Impact Case Study series was partially launched in April 2022 with three Microsoft Sway webpages, Program Impact Case Study: AHL, Program Impact Case Study: AFL, and Program Impact Case Study: VCP, as well as fully accessibly PDFs available on the Ontario Agri-Food Innovation Alliance Our Impact: Case Studies webpage. The series was promoted in the Alliance's monthly newsletter in April and a social media campaign was prepared. Due to the provincial election, the social media campaign was paused and will

[4] "Average Industry rates," Constant Contact, last modified 2022, https://knowledgebase.constantcontact.com/articles/KnowledgeBase/5409-average-industry-rates?lang=en_US

resume in 2022/23, following the election. Engagement metrics will be provided in the next annual report, once the social media and broader promotion campaign is complete.

1.6.5 Social Media

Alliance social media continued on both Twitter and LinkedIn in 2021/22. Due to staffing changes and resource limitations, there was a decrease in the frequency of posts from the @AgInnovationON account from 210 tweets in 2020/21 to 166 tweets in 2021/22. This resulted in a decrease across all metrics including impressions, engagement, likes, and URL clicks. However, the number of followers still increased and impressions per tweet held steady. The overall decrease was in relation to the quantity of tweets, not quality.

Another factor in the reduction of key metrics was the pause of the *Growing Ontario Solutions* campaign in 2021/22, which was the highest performing social media campaign in 2020/21.

The impact of quantity of tweets will be used to inform social media over 2022/23, as well as the influence that specific campaigns, such as *Growing Ontario Solutions*, had on engagement.

Table 1.2 provides several Twitter metrics for @AgInnovationON.

Table 1.2: Twitter Metrics for @AgInnovationON

Metric	2018/19	2019/20	2020/21	2021/22	Percentage Change from Prev. Year
Tweets		141	210	166	-21%
Followers	3,504	3,665	3,943	4,175	6%
Impressions	173,975	126,659	253,515	208,138	-18%
Engagements	2,091	2,119	4,477	2,895	-35%
Average Engagement Rate	1.3%	1.7%	1.6%	1.2%	-25%
Retweets	256	236	528	449	-15%
Likes	334	429	852	689	-19%
URL Clicks	388	376	626	517	-17%

During the same period, the @DairyFacility Twitter account attracted 96 new followers, an increase of 5%.

In February 2020, the Alliance's LinkedIn page was transitioned from a legacy page type to a new organization page type, resetting the number of followers to zero. Since then, the number of followers has grown steadily as shown in Table 1.3. Work to re-build an engaged audience will continue in 2022/23.

Table 1.3: LinkedIn Metrics for Ontario Agri-Food Innovation Alliance

Metric	2019/20	2020/21	2021/22	Percentage Change from Prev. Year
Followers	35	98	190	+94%
Impressions			7,145	
URL Clicks			283	

2 FINANCIAL SUMMARY AND ANALYSIS

2.1 Definitions

Tables 2.1, 2.2 and 2.3 provide the definitions for the terms used in many of the financial tables in this section of the report.

Table 2.1: Revenue Definitions

Revenue	Definition
OMAFRA Agreement	The portion of the total Agreement funding recognized for eligible expenses, (net of program revenues) in the current University fiscal year (May 1, 2021 to April 30, 2022).
OMAFRA Other	This revenue includes OMAFRA funding, outside of the Agreement, designated for specific activities (e.g., $500K in support of equipment purchases in AHL and AFL).
Sales of Goods and Services	Sales of goods and services, from Agreement operations, provided to external organizations and clients. This category includes revenues for testing services provided by AHL and AFL and sale of produce from the Research Centres.
Investment Income	Interest earned on the Agreement Account (as per Section 10.7 of the Agreement) and recognized in the period. Investment income will only be recognized when there are approved expenditures by the Executive Committee.
Other Revenue	Miscellaneous revenues generated from Agreement operations. The major component is facility rental income for space managed within the Property Management program. It may also include sponsorships, recoveries from the disposal of surplus equipment, labour recoveries, or other miscellaneous program revenues. Other Revenues are typically irregular items that do not necessarily recur annually.

Table 2.2: Expense Definitions

Expense	Definition
Salary and Wages	All salary and wage costs for University of Guelph employees excluding transfers for the Research and VCP faculty costs (refer to Faculty Pool Costs definition).
Non Salary Benefits	This includes non salary costs for statutory and negotiated employee benefit programs and eligible pension costs. Non Salary Benefits are allocated using the standardized pooled costing method applied to all University sponsors and funding sources.
Faculty Pool Costs	Agreement funds transferred to the University in support of the salary and benefits costs of University faculty effort toward Agreement priorities. Two “pools” have been established for the Research and Veterinary Capacity Programs.
Travel	Eligible expenditures for approved travel on Agreement supported program activities.

Expense	Definition
Operating	Expenses for all costs other than salary, benefits, and travel. Operating expenses include utilities, fuel, and energy costs; equipment lease costs; contracts for services (e.g., janitorial, garbage disposal, etc.); maintenance and repairs costs; laboratory supplies; research supplies; farm supplies (e.g., feed and bedding for animals, seeds, pesticides, fertilizer, etc.); telephone and computer costs; animal purchases; and scholarships.
Internal Recoveries	Recovery of costs between units within the University for goods and services provided such as lab testing performed by AHL or AFL or Research Centre recoveries from researchers. The charges for these recoveries are normally approved as 'invoices' for services between the specific unit requisitioners and providers within the University. Internal charges are recorded under Operating.
Budget Adjustment	This is the difference between the Annual Maximum Funds and the sum of the program budgets as approved by the Executive Committee. It only applies to the General and Inflation Reserve.

Table 2.3: Column Definitions

Column	Definition
2021/22 Results	Actual revenue or expenses recorded for the period of May 1, 2021 to April 30, 2022.
2021/22 Budget	2021/22 Annual Budget allocated for each category, excluding carry forwards.
Variance	Difference between Budget and Results.
% Variance > 5% and > $10K	Where the Results differ from the Budget by greater than 5% and the variance is greater than $10K.

2.2 Agreement Financial Summary

Table 2.4 provides the Agreement Financial Summary which includes all revenues and expenditures by Standard Accounts for the Agreement. The table includes the 2021/22 Results, 2021/22 Budget, Variance, and Percentage Variance when greater than 5% and $10K. This summary does not include ARIO Minor Capital.

In 2021/22, the net Agreement result was a negative balance of $3,803K. This was due to increases in committed carry forwards in two programs, offset by an intentional draw down of $4,554K from the uncommitted carry forward.

Table 2.4: Agreement Financial Summary for 2021/22 (in thousands of dollars)

Standard Accounts	2021/22 Results	2021/22 Budget	Variance	% Variance > 5% and > $10K
Revenue				
OMAFRA Agreement	(69,903)	(66,100)	3,803	6%
OMAFRA Other (Lab. Equip.)	(500)	(500)	0	
Sales Goods and Services	(22,331)	(21,472)	859	
Investment Income	0	0	0	
Other Revenue	(838)	(620)	219	35%
Revenue Total	**(93,572)**	**(88,691)**	**4,881**	**6%**
Expenses				
Salary and Wages	35,457	36,200	743	
Non Salary Benefits	8,813	9,315	502	5%
Faculty Pool Costs	13,045	13,045	0	
Travel	346	830	484	58%
Operating	41,009	38,117	(2,892)	-8%
Internal Recoveries	(5,097)	(4,261)	836	20%
Budget Adjustment	0	(4,554)	(4,554)	
Expenses Total	**93,572**	**88,691**	**(4,881)**	**-6%**
Grand Total	**0**	**0**	**0**	

Carry Forward into 2021/22	38,837
Changed in Carry Forward	(3,803)
Carry Forward into 2022/23	35,033

Figure 2.1 illustrates the Agreement Revenue by Standard Accounts, while Figure 2.2 shows the Agreement Expenses.

Figure 2.1: Agreement Revenue by Standard Accounts for 2021/22 (in thousands of dollars)

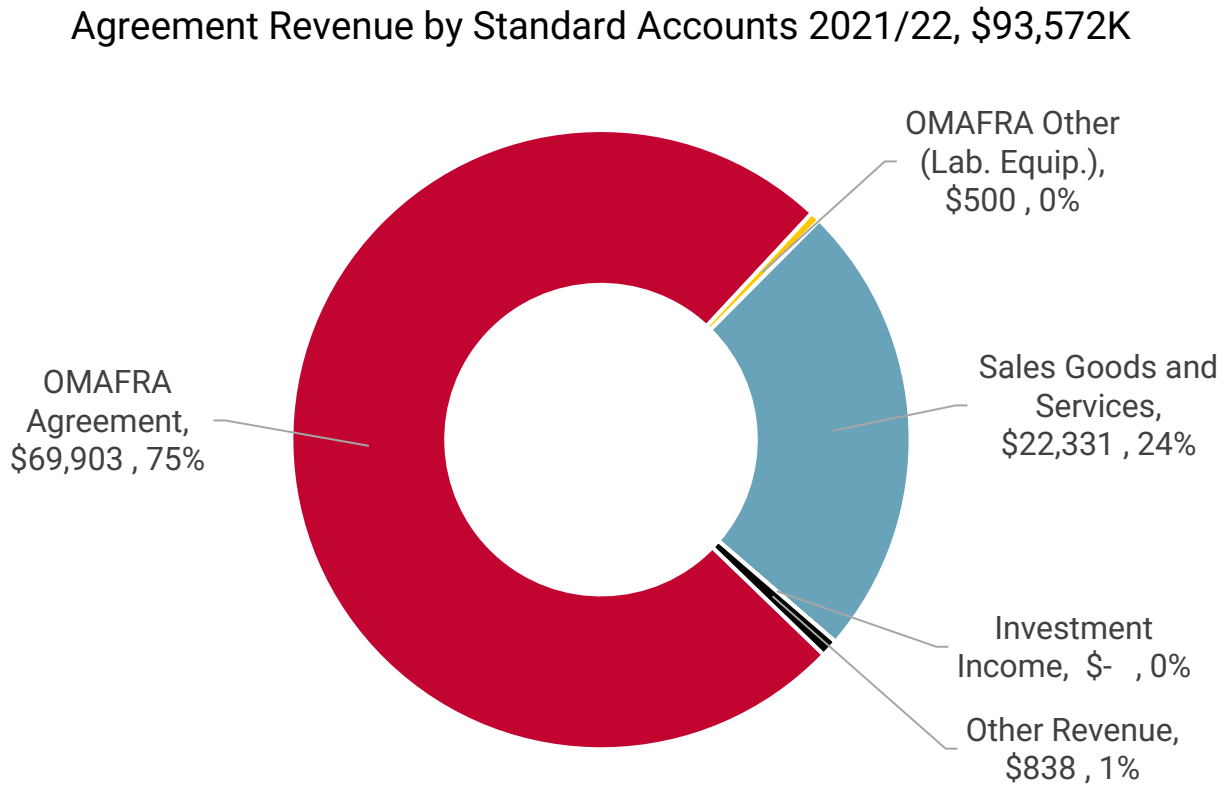


Figure 2.2: Agreement Expenses by Standard Accounts for 2021/22 (in thousands of dollars)

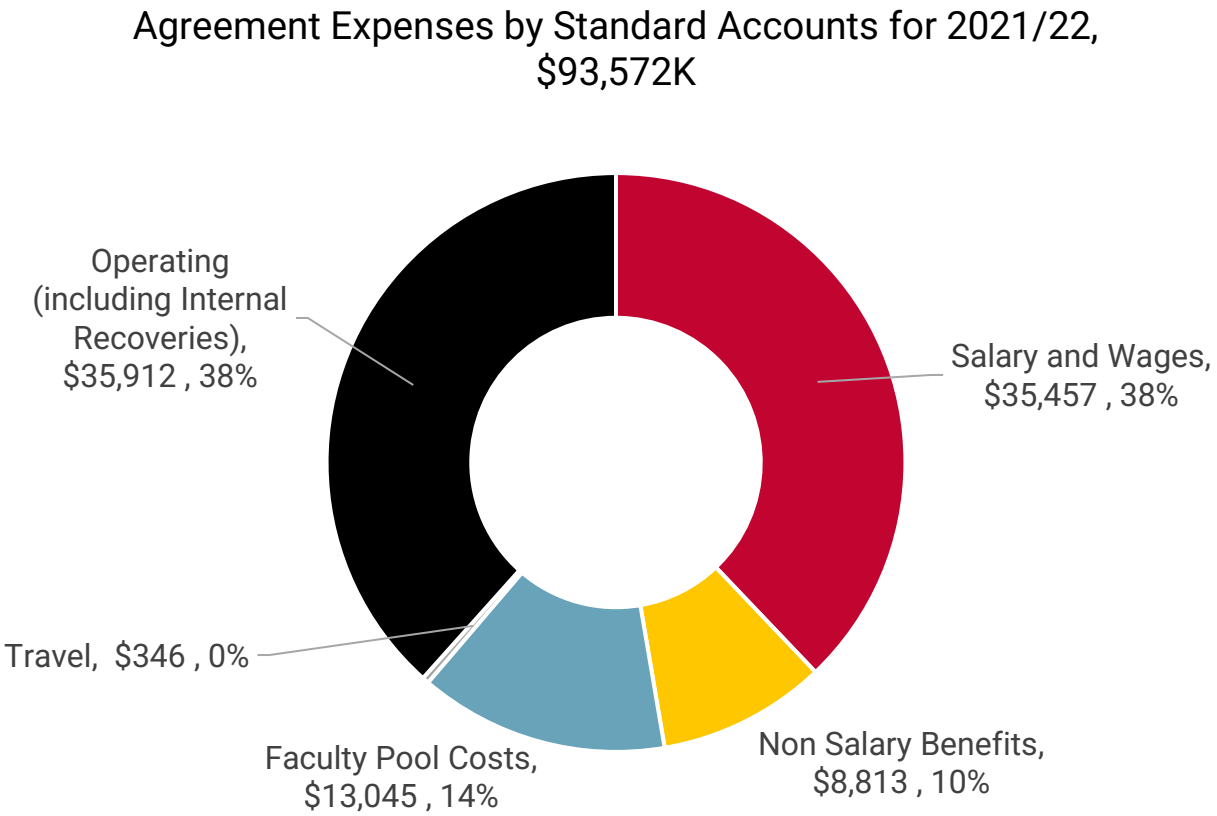


Table 2.5 shows the Agreement Financial Summary by Program for 2021/22.

Table 2.5: Agreement Financial Summary by Program for 2021/22 (in thousands of dollars)

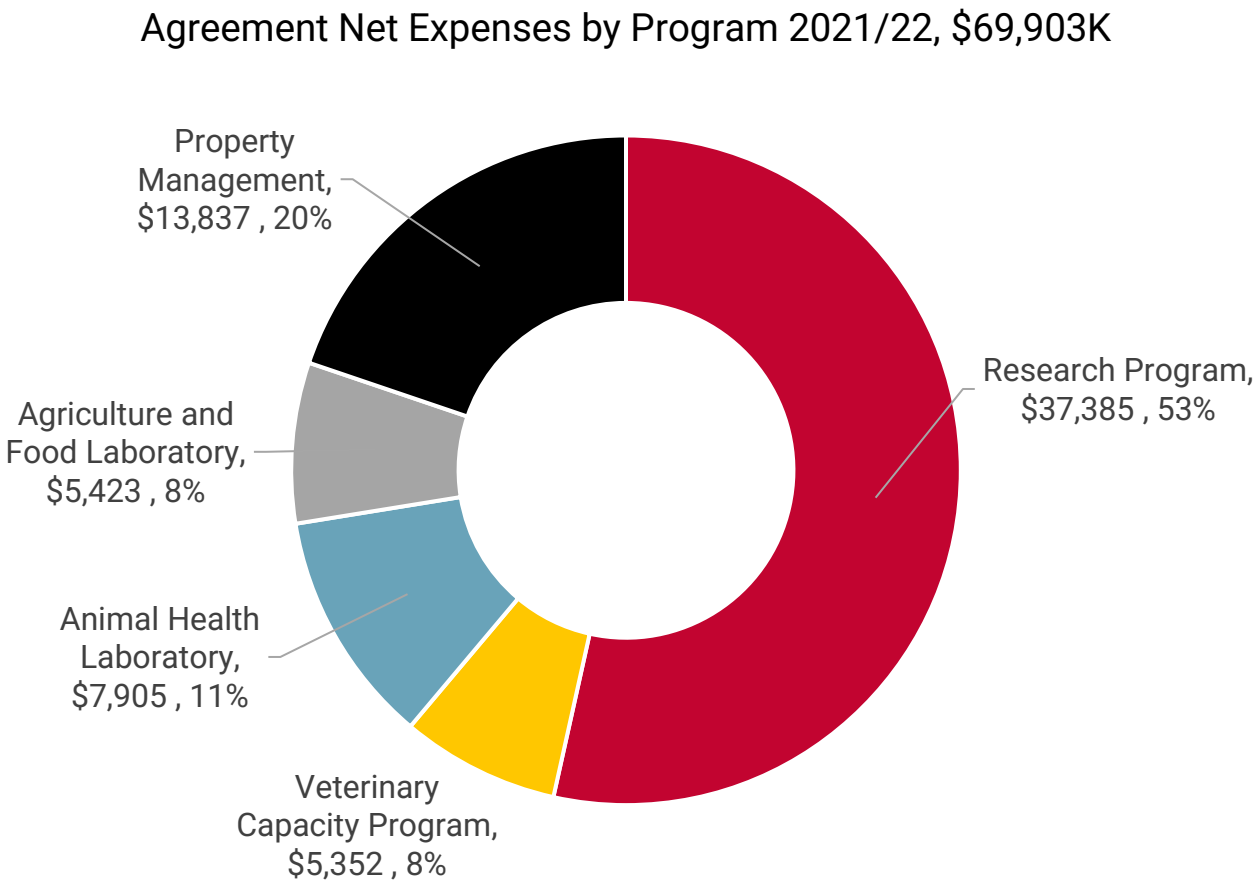
Standard Accounts	Research Program	Veterinary Capacity Program	Animal Health Laboratory	Agriculture and Food Laboratory	Property Management	General & Inflation Reserve	Exigency Fund (Recognized)	Total
Revenue								
OMAFRA Agreement	(37,385)	(5,352)	(7,905)	(5,423)	(13,837)	0	0	**(69,903)**
OMAFRA Other (Lab. Equip.)				(500)				**(500)**
Sales Goods and Services	(29)		(8,482)	(8,915)	(4,905)			**(22,331)**
Investment Income								**0**
Other Revenue	(71)		(43)	(53)	(672)			**(838)**
Revenue Total	**(37,485)**	**(5,352)**	**(16,430)**	**(14,891)**	**(19,414)**	**0**	**0**	**(93,572)**
Expenses								
Salary and Wages	10,693	175	8,271	8,116	8,201			**35,457**
Non Salary Benefits	2,002	29	2,269	2,341	2,173			**8,813**
Faculty Pool Costs	11,145	1,900						**13,045**
Travel	126	195	6	8	11			**346**
Operating	14,405	3,054	7,845	5,199	10,506			**41,009**
Internal Recoveries	(886)	0	(1,961)	(773)	(1,478)			**(5,097)**
Expenses Total	**37,485**	**5,352**	**16,430**	**14,891**	**19,414**	**0**	**0**	**93,572**
Grand Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2021/22 Budget	**37,782**	**5,343**	**7,930**	**5,953**	**13,646**	**(4,554)**	**0**	**66,100**
Change in Carry Forward (Budget + OMAFRA Agreement)	**397**	**(9)**	**25**	**530**	**(191)**	**(4,554)**	**0**	**(3,803)**
Carry Forward into 2021/22	**21,063**	**7**	**5,170**	**1,030**	**491**	**11,075**	**0**	**38,837**
Carry Forward into 2022/23	**21,460**	**(2)**	**5,194**	**1,560**	**300**	**6,521**	**0**	**35,033**

Table 2.6 illustrates the results (net expenses) by program for 2021/22 compared to budget. Figure 2.3 shows the net expenses in a visual format. It does not include the General & Inflation Reserve or the Exigency Fund (Recognized).

Table 2.6: Net Expenses by Program for 2021/22 (in thousands of dollars)

Program Schedule	2021/22 Results	2021/22 Budget	Variance	% Variance > 5% and > $10K
Research Program	37,385	37,782	397	
Veterinary Capacity Program	5,352	5,343	(9)	
Animal Health Laboratory	7,905	7,930	25	
Agriculture and Food Laboratory	5,423	5,953	530	9%
Property Management	13,837	13,646	(191)	
General & Inflation Reserve	0	(4,554)	(4,554)	
Exigency Fund (Recognized)	0	0	0	
Grand Total	**69,903**	**66,100**	**(3,803)**	**-6%**

Figure 2.3: Agreement Net Expenses by Program for 2021/22 (in thousands of dollars)



2.3 Program Financial Summaries

The program financial summaries are presented in the five subsections below. They include an analysis of the significant variances against budget, as well as a description of any surpluses or shortfalls.

2.3.1 Research Program

The Research Program summary is presented in Table 2.7. The 2021/22 result of $37,385K was $397K less than the 2021/22 budget of $37,782K, a variance of 1%.

Other Revenue had a positive variance of $54K. The variance is related to external student labour recoveries, as well as some other general recoveries in Research Projects and Research Support. These recoveries tend to vary from year to year, so are difficult to budget for.

Travel costs were 72% under budget. Travel was reduced in several ways due to the COVID-19 pandemic. Many Knowledge Translation and Transfer (KTT) events, industry meetings, and academic conferences were converted to virtual, no longer requiring faculty members to attend them in person, reducing travel costs. In addition, the University did not host many KTT events, limiting hospitality costs as well. It is anticipated that researchers will have modified their project plans to delay travel to future years or shifted expenditures to avoid the need to travel. Internal recoveries were $273K over budget, a positive variance of 45%. This was due to the HQP Scholarship Program, and the additional support provided from Food from Thought.

Table 2.7: 2021/22 Research Program Financial Summary (in thousands of dollars)

Standard Accounts	2021/22 Results	2021/22 Budget	Variance	% Variance > 5% and > $10K
Revenue				
Sales Goods and Services	(29)	(30)	(1)	
Other Revenue	(71)	(17)	54	310%
Revenue Total	**(100)**	**(47)**	**53**	**111%**
Expenses				
Salary and Wages	10,693	10,889	196	
Non Salary Benefits	2,002	2,062	60	
Faculty Pool Costs	11,145	11,145	0	
Travel	126	457	331	72%
Operating	14,405	13,889	(516)	
Internal Recoveries	(886)	(613)	273	45%
Expenses Total	**37,485**	**37,829**	**344**	
Grand Total	**37,385**	**37,782**	**397**	

Carry Forward into 2021/22	21,063
Carry Forward into 2022/23	21,460

Table 2.8 provides the 2021/22 results for the program activities in the Research Program, as well as the related carry forwards.

Table 2.8: 2021/22 Results for the Program Activities in the Research Program (in thousands of dollars)

Standard Accounts	Research Faculty	Research Support	HQP Scholarship Program	Research Project Operating	Research Innovation Office	Gryphon's LAAIR	KTT Program	Indirect Costs	Total
Revenue									
Sales Goods and Services	0	(29)	0	0	0	0	0	0	**(29)**
Other Revenue	0	(42)	0	(26)	0	0	(3)	0	**(71)**
Revenue Total	**0**	**(71)**	**0**	**(26)**	**0**	**0**	**(3)**	**0**	**(100)**
Expenses									
Salary and Wages	0	5,471	0	4,619	175	164	264	0	**10,693**
Non Salary Benefits	0	1,533	0	382	36	17	33	0	**2,002**
Faculty Pool Costs	11,145	0	0	0	0	0	0	0	**11,145**
Travel	0	20	0	75	0	20	10	0	**126**
Operating	0	1,169	845	2,194	5	214	147	9,830	**14,405**
Internal Recoveries	0	(278)	(559)	(48)	0	(0)	0	0	**(886)**
Expenses Total	**11,145**	**7,916**	**285**	**7,222**	**216**	**415**	**455**	**9,830**	**37,485**
Grand Total	**11,145**	**7,845**	**285**	**7,196**	**216**	**415**	**452**	**9,830**	**37,385**
2021/22 Budget	**11,145**	**7,632**	**250**	**7,775**	**250**	**400**	**500**	**9,830**	**37,782**
Variance	**0**	**(213)**	**(35)**	**579**	**34**	**(15)**	**48**	**0**	**397**
Carry Forward into 2021/22	**0**	**3,552**	**244**	**16,095**	**1**	**447**	**723**	**0**	**21,063**
Carry Forward into 2022/23	**0**	**3,339**	**209**	**16,674**	**35**	**432**	**772**	**0**	**21,460**

The opening carry forward for the Research Program was $21,063K. The closing carry forward for 2021/22 was $21,460K. More details about many of the program activity carry forwards can be found in Section 2.5.

2.3.1.1 Components of the Research Project Operating Program Activity

Table 2.9 provides the breakdown of the components of the Research Project Operating program activity, as well as the related carry forwards.

Table 2.9: 2021/22 Results for the Components of the Research Project Operating Program Activity
(in thousands of dollars)

Standard Accounts	Research Project Operating - Tier I	Research Project Operating - Special Initiatives	Research Project Operating - USEL	Research Project Operating - Total
Revenue				
Sales Goods and Services	0	0	0	0
Other Revenue	(26)	0	0	(26)
Revenue Total	**(26)**	**0**	**0**	**(26)**
Expenses				
Salary and Wages	3,807	701	110	4,619
Non Salary Benefits	294	77	10	382
Faculty Pool Costs	0	0	0	0
Travel	67	6	2	75
Operating	2,441	(249)	3	2,194
Internal Recoveries	(39)	(9)	0	(48)
Expenses Total	**6,571**	**526**	**125**	**7,222**
Grand Total	**6,545**	**526**	**125**	**7,196**
2021/22 Budget	**6,660**	**1,000**	**115**	**7,775**
Variance	**115**	**474**	**(10)**	**579**
Carry Forward into 2021/22	**12,667**	**3,417**	**12**	**16,095**
Carry Forward into 2022/23	**12,782**	**3,891**	**2**	**16,674**

2.3.1.2 Components of the Research Support Program Activity

Table 2.10 provides the breakdown of the components of the Research Support program activity, as well as the related carry forwards.

Table 2.10: 2021/22 Results for the Components of the Research Support Program Activity
(in thousands of dollars)

Standard Accounts	Research Support - General	Research Support - Long Term Trials	Research Support - Total
Revenue			
Sales Goods and Services	(29)	0	(29)
Other Revenue	(42)	0	(42)
Revenue Total	**(71)**	**0**	**(71)**
Expenses			
Salary and Wages	5,359	112	5,471
Non Salary Benefits	1,522	11	1,533
Faculty Pool Costs	0	0	0
Travel	20	0	20
Operating	1,083	86	1,169
Internal Recoveries	(278)	0	(278)
Expenses Total	**7,706**	**210**	**7,916**
Grand Total	**7,635**	**210**	**7,845**
2021/22 Budget	**7,432**	**200**	**7,632**
Variance	**(203)**	**(10)**	**(213)**
Carry Forward into 2021/22	**3,520**	**32**	**3,552**
Carry Forward into 2022/23	**3,317**	**22**	**3,339**

2.3.2 Veterinary Capacity Program

The Veterinary Capacity Program (VCP) financial summary is presented in Table 2.11. The 2021/22 result of $5,352K was slightly more than the 2021/22 budget, with a few very minor variances by category.

Table 2.11: 2021/22 Veterinary Capacity Program Financial Summary (in thousands of dollars)

Standard Accounts	2021/22 Results	2021/22 Budget	Variance	% Variance > 5% and > $10K
Expenses				
Salary and Wages	175	169	(6)	
Non Salary Benefits	29	28	(1)	
Faculty Pool Costs	1,900	1,900	0	
Travel	195	198	2	
Operating	3,054	3,049	(5)	
Internal Recoveries	0	0	0	
Expenses Total	**5,352**	**5,343**	**(9)**	
Grand Total	**5,352**	**5,343**	**(9)**	

Carry Forward into 2021/22	7
Carry Forward into 2022/23	(2)

Table 2.12 provides the 2021/22 results for the program activities in the Veterinary Capacity Program, as well as the related carry forwards. The opening carry forward for VCP was $7K. The closing carry forward for 2021/22 was negative $2K. This small deficit will be resolved in 2022/23.

Table 2.12: 2021/22 Results for the Program Activities in the Veterinary Capacity Program
(in thousands of dollars)

Standard Accounts	VCP HSC Staff, Veterinarians, Operations	VCP Faculty	VCP Externships; Summer Student Experience Placements	VCP Internships; Residency Programs	VCP Doctoral Programs	Total
Expenses						
Salary and Wages	143	0	0	32	0	**175**
Non Salary Benefits	24	0	0	5	0	**29**
Faculty Pool Costs	0	1,900	0	0	0	**1,900**
Travel	0	0	195	0	0	**195**
Operating	2,426	0	0	133	495	**3,054**
Internal Recoveries	0	0	0	0	0	**0**
Expenses Total	**2,592**	**1,900**	**195**	**170**	**495**	**5,352**
Grand Total	**2,592**	**1,900**	**195**	**170**	**495**	**5,352**
2021/22 Budget	**2,583**	**1,900**	**195**	**170**	**495**	**5,343**
Variance	**(9)**	**0**	**0**	**0**	**0**	**(9)**
Carry Forward into 2021/22	**7**	**0**	**0**	**0**	**0**	**7**
Carry Forward into 2022/23	**(2)**	**0**	**0**	**0**	**0**	**(2)**

2.3.2.1 Transfers to the OVC Health Sciences Centre

Table 2.13 provides a breakdown of the transfers to the Ontario Veterinary College (OVC) Health Sciences Centre (HSC) by resource type. The transfers make up a significant portion of the Operating costs in the VCP HSC Staff, Veterinarians, Operations program activity.

Table 2.13: 2021/22 Transfers to the Ontario Veterinary College Health Sciences Centre

Resource	FTE	Total (in thousands of dollars)
Veterinarians	**1.00**	**161**
Large Animal Medicine Clinic - Ruminant Service	1.00	161
Animal Housing Staff	**8.00**	**648**
Large Animal Housing	8.00	648
Technical Staff	**17.91**	**1,587**
Large Animal Medicine Clinic - Ruminant Service	1.00	91
Large Animal Wards	16.91	1,495
Total	**26.91**	**2,396**

2.3.3 Animal Health Laboratory

The Animal Health Laboratory (AHL) financial summary is presented in Table 2.14. The 2021/22 result of $7,905K was $25K less than the 2021/22 budget of $7,930K, a variance of 0.3%.

In AHL, Other Revenue was $41K over budget This was predominately due to funding received from OMAFRA through the Canadian Agricultural Partnership (CAP) program to support emergency preparedness related to Avian Influenza and African Swine Fever.

Travel expenses were 95% under budget, due to the lingering impact of the COVID-19 pandemic on face-to-face attendance at meetings and conferences. Operating expenses were over budget by $979K or 14%. While there were multiple factors at play, this was primarily due to equipment reinvestment costs of $1,899K. This included equipment approved in the 2020/21 Business Plan, the 2021/22 Business Plan, and approved during the year by the AHL Program Management Committee (PMC). This was offset by slow rates of expenditures in OAHN projects, savings related to the Bee and Apiary Health Testing program, and operational savings in AHL Testing and Laboratory Services Division (LSD) Central Administration.

Table 2.14: 2021/22 Animal Health Laboratory Financial Summary (in thousands of dollars)

Standard Accounts	2021/22 Results	2021/22 Budget	Variance	% Variance > 5% and > $10K
Revenue				
OMAFRA Other	0	0	0	
Sales Goods and Services	(8,482)	(8,178)	305	
Other Revenue	(43)	(2)	41	2278%
Revenue Total	**(8,525)**	**(8,179)**	**346**	
Expenses				
Salary and Wages	8,271	8,670	399	
Non Salary Benefits	2,269	2,365	96	
Travel	6	124	118	95%
Operating	7,845	6,866	(979)	-14%
Internal Recoveries	(1,961)	(1,916)	45	
Expenses Total	**16,430**	**16,109**	**(321)**	
Grand Total	**7,905**	**7,930**	**25**	

Carry Forward into 2021/22	5,170
Carry Forward into 2022/23	5,194

Table 2.15 delivers the 2021/22 results for the program activities in the Animal Health Laboratory, as well as the related carry forwards.

Table 2.15: 2021/22 Results for the Program Activities in the Animal Health Laboratory (in thousands of dollars)

Standard Accounts	AHL Testing/Programs	Bee and Apiary Health Testing	AHL LSD Central Administration	OAHN Operations	OAHN Projects	Total
Revenue						
OMAFRA Other	0	0	0	0	0	**0**
Sales Goods and Services	(8,482)	0	0	0	0	**(8,482)**
Other Revenue	(41)	0	(2)	0	0	**(43)**
Revenue Total	**(8,523)**	**0**	**(2)**	**0**	**0**	**(8,525)**
Expenses						
Salary and Wages	6,916	0	834	503	18	**8,271**
Non Salary Benefits	1,906	0	243	118	2	**2,269**
Travel	3	0	3	0	0	**6**
Operating	7,082	0	584	46	133	**7,845**
Internal Recoveries	(1,961)	0	0	0	0	**(1,961)**
Expenses Total	**13,946**	**0**	**1,664**	**667**	**153**	**16,430**
Grand Total	**5,424**	**0**	**1,661**	**667**	**153**	**7,905**
2021/22 Budget	**5,186**	**0**	**1,840**	**649**	**255**	**7,930**
Variance	**(238)**	**0**	**179**	**(18)**	**102**	**25**
Carry Forward into 2021/22	**4,491**	**0**	**0**	**281**	**398**	**5,170**
Carry Forward into 2022/23	**4,253**	**0**	**179**	**262**	**500**	**5,194**

The opening carry forward for AHL was $5,170K. The closing carry forward for 2021/22 was $5,194K. The AHL LSD Central Administration carry forward will be consolidated to AHL Testing/Programs for the start of 2022/23. The funds in AHL Testing/Programs will be used to support future equipment purchases. More details about the Ontario Animal Health Network (OAHN) Projects carry forward can be found in Section 2.3.3.1.

2.3.3.1 OAHN Projects

Table 2.16 provides the details for the OAHN Projects program activity. This program activity functions similarly to the project-based activities in the Research Program. Awards are provided to investigators to aid in the completion of surveillance projects throughout the year. Expenditures are made against the projects, which may or may not occur in the same fiscal year as the awards.

The budget for OAHN Projects was $255K in 2021/22. There were 11 projects awarded, with a total value of $133K. The remaining $122K will be carried forward to future years.

In total, there are $251K in unallocated funds in this program activity.

Table 2.16: 2021/22 OAHN Projects Program Details (in thousands of dollars)

Year 4 - 2021/22	Previous Results	2021/22 Results	Balance in Project Accounts	Committed to Future Years	Total	Number of Projects Awarded	Number of Projects Completed
2021/22 Projects	**0**	**36**	**97**	**122**	**255**	**11**	**0**
OAHN Projects		36	97	0	**133**	11	0
Unallocated				122	**122**		
2020/21 Projects	**59**	**71**	**66**	**55**	**250**	**12**	**2**
OAHN Projects	59	71	66	0	**195**	12	2
Unallocated				55	**55**		
2019/20 Projects	**128**	**18**	**80**	**34**	**261**	**14**	**7**
OAHN Projects	128	18	80	0	**226**	14	7
Unallocated				34	**34**		
2018/19 Projects	**180**	**28**	**6**	**41**	**256**	**15**	**13**
OAHN Projects	180	28	6	0	**215**	15	13
Unallocated				41	**41**		
Total	**368**	**153**	**249**	**251**	**1,021**	**52**	**22**

2.3.4 Agriculture and Food Laboratory

The Agriculture and Food Laboratory (AFL) summary is presented in Table 2.17. The 2021/22 result of $5,423K was $530K less than the 2021/22 budget of $5,953K, a positive variance of 9%.

Other Revenue was $47K over budget. This was due to external labour recoveries for student employees.

Salary and Wages were $432K or 5% under budget. This was primarily related to staff turnover in the Chemistry unit. Non Salary Benefits were under budget by 10%. This was due to the savings in the Salary and Wages category, as well as the utilization of temporary full-time staff, who have a lower benefit rate, to cover absences of regular incumbents.

Travel expenses were 74% under budget. This is due to the lingering impact of the COVID-19 pandemic on face-to-face attendance at meetings, tradeshows, and conferences. Operating expenses were $541K or 12% over budget. This was due to equipment reinvestment costs of $840K ($500K is part of the budget (OMAFRA CAPEX program), so only $340K impacted the variance). Finally, Internal Recoveries were $209K over budget, with a positive variance of 37%. This was related to stronger than expected internal testing revenue in the Analytical Biology Super Centre.

Table 2.17: 2021/22 Agriculture and Food Laboratory Financial Summary (in thousands of dollars)

Standard Accounts	2021/22 Results	2021/22 Budget	Variance	% Variance > 5% and > $10K
Revenue				
OMAFRA Other	(500)	(500)	0	
Sales Goods and Services	(8,915)	(8,820)	95	
Other Revenue	(53)	(6)	47	757%
Revenue Total	**(9,468)**	**(9,326)**	**142**	
Expenses				
Salary and Wages	8,116	8,548	432	5%
Non Salary Benefits	2,341	2,607	266	10%
Travel	8	30	22	74%
Operating	5,199	4,658	(541)	-12%
Internal Recoveries	(773)	(564)	209	37%
Expenses Total	**14,891**	**15,279**	**388**	
Grand Total	**5,423**	**5,953**	**530**	**9%**

Carry Forward into 2021/22	1,030
Carry Forward into 2022/23	1,560

Table 2.18 provides the 2021/22 results for the program activities in the Agriculture and Food Laboratory, as well as the related carry forwards.

Table 2.18: 2021/22 Results for the Program Activities in the Agriculture and Food Laboratory
(in thousands of dollars)

Standard Accounts	AFL Program Testing/Programs	AFL LSD Central Administration	Total
Revenue			
OMAFRA Other	(500)	0	**(500)**
Sales Goods and Services	(8,862)	(53)	**(8,915)**
Other Revenue	(46)	(7)	**(53)**
Revenue Total	**(9,408)**	**(60)**	**(9,468)**
Expenses			
Salary and Wages	6,856	1,260	**8,116**
Non Salary Benefits	1,966	374	**2,341**
Travel	3	5	**8**
Operating	4,484	715	**5,199**
Internal Recoveries	(769)	(4)	**(773)**
Expenses Total	**12,541**	**2,350**	**14,891**
Grand Total	**3,133**	**2,290**	**5,423**
2021/22 Budget	**3,188**	**2,765**	**5,953**
Variance	**55**	**475**	**530**
Carry Forward into 2021/22	**1,030**	**0**	**1,030**
Carry Forward into 2022/23	**1,085**	**475**	**1,560**

The opening carry forward for AFL was $1,030K. The closing carry forward for 2021/22 was $1,560K. The AFL LSD Central Administration carry forward will be consolidated to AFL Testing/Programs for the 2022/23 year. These funds are committed to future equipment purchases.

2.3.4.1 Third-Party Revenue

Table 2.19 illustrates the amount and percentage of revenue generated by source on an annual basis in the Agriculture and Food Laboratory. In 2021/22, 59.7% of AFL's revenue came from third-party testing contracts, which compares to 56.9% in 2020/21.

Table 2.19: 2021/22 Revenue Generated by Source in AFL (in thousands of dollars)

Source	Revenue	Percentage
Revenue from the OMAFRA Agreement (shown as budget)	5,953	40.0%
Testing for OMAFRA outside of the Agreement	44	0.3%
Third-Party Testing Contracts	8,871	59.7%
Total	**14,868**	

2.3.5 Property Management Program

The Property Management program summary is presented in Table 2.20. The original 2021/22 Property Management schedule budget was $13,396K. The net budget was increased to $13,646K to account for the delayed sale of the main campus portion of the Alfred Property. The 2021/22 result of $13,837K was $191K over the revised 2021/22 budget.

Sales Goods and Services were $460K or 10% over budget. This was mainly related to an increase in crop revenue connected to Research Station Operations. This is expected to be a one-time occurrence as it relates to a confluence of factors: excellent yield due to good weather; strong commodity prices; and a temporary reduction in the feed requirements due to decreased number of animals during facility redevelopment. Other Revenue was $77K or 13% over budget. This was primarily due to external student labour recoveries.

Travel was 47% under budget due to the COVID-19 pandemic. Operating costs were $851K over budget, with a negative variance of 9%. In addition to the regular variations in this category, there were a few specific items that increased the size of the variance. These included: equipment replacement costs in the Growth Facilities (approved by R/PM PMC in February 2022); the purchase of additional beef cattle to fill the new feedlot facility in Elora; higher input costs in Research Station Operations; and greater than normal veterinary service costs. Finally, Internal Recoveries were $310K or 27% over budget. This was due to an increase in the number of animals processed at the Meat Laboratory (internal sales are shown as Internal Recoveries) versus sold at market (external sales are shown as Sales Good and Services), as well as higher than expected labour recoveries.

Table 2.20: 2021/22 Property Management Program Financial Summary (in thousands of dollars)

Standard Accounts	2021/22 Results	2021/22 Budget	Variance	% Variance > 5% and > $10K
Revenue				
Sales Goods and Services	(4,905)	(4,445)	460	10%
Other Revenue	(672)	(594)	77	13%
Revenue Total	**(5,576)**	**(5,039)**	**538**	**11%**
Expenses				
Salary and Wages	8,201	7,924	(278)	
Non Salary Benefits	2,173	2,253	80	
Travel	11	21	10	47%
Operating	10,506	9,656	(851)	-9%
Internal Recoveries	(1,478)	(1,169)	310	27%
Expenses Total	**19,414**	**18,685**	**(729)**	
Grand Total	**13,837**	**13,646**	**(191)**	

Carry Forward into 2021/22	491
Carry Forward into 2022/23	300

Table 2.21 delivers the 2021/22 results for the program activities in the Property Management program, as well as the related carry forwards.

Table 2.21: 2021/22 Results for Program Activities in the Property Management Program
(in thousands of dollars)

Standard Accounts	ARIO Properties Operations - Maintenance and Repairs	ARIO Properties Operations - Personnel and Operating	Agreement Vineland Employees	Vineland Research Station Operations and Maintenance	Total
Revenue					
Sales Goods and Services	0	(4,905)	0	0	**(4,905)**
Other Revenue	(455)	(217)	0	0	**(672)**
Revenue Total	**(455)**	**(5,122)**	**0**	**0**	**(5,576)**
Expenses					
Salary and Wages	817	7,109	276	0	**8,201**
Non Salary Benefits	210	1,875	88	0	**2,173**
Travel	0	11	0	0	**11**
Operating	4,413	5,246	4	844	**10,506**
Internal Recoveries	(212)	(1,261)	(6)	0	**(1,478)**
Expenses Total	**5,228**	**12,980**	**362**	**844**	**19,414**
Grand Total	**4,774**	**7,858**	**362**	**844**	**13,837**
2021/22 Budget	**4,939**	**7,517**	**368**	**823**	**13,646**
Variance	**165**	**(342)**	**7**	**(21)**	**(191)**
Carry Forward into 2021/22	**48**	**421**	**2**	**20**	**491**
Carry Forward into 2022/23	**213**	**79**	**9**	**(1)**	**300**

The opening carry forward related to Property Management was $491K. The closing carry forward for 2021/22 was $300K.

2.3.5.1 Revenues and Expenditures by ARIO Property

Table 2.22 provides the financial breakdown of the total revenues and expenditures in 2021/22 for each of the Research Centres. A discussion follows for the Research Centres that had a variance which was more than 5% of the budgeted expenses and greater than $10K. Overall, the Research Centres finished the year with a small negative variance of $68K, which was approximately 0.4% of the total budgeted expenses.

The Ontario Aquaculture Research Centre had a surplus of $105K, with a positive variance of 14%. Most of the variance was related to stronger than expected program revenue and fish sales.

The Equine Research Facility - Arkell had a deficit of $16K, with a negative variance of 6%. Much of the variance was related to increased student labour costs.

The Ontario Crops Research Centre - Bradford had a surplus of $19K, with a positive variance of 6%. This was due to a student labour recovery, as well as lower than normal operating costs.

The Guelph Research Station was over budget by $58K, with a negative variance of 21%. The majority of this was related to the costs of establishing and operating the new turfgrass site. The costs are expected to stabilize in 2022/23.

Table 2.22: 2021/22 Financial Breakdown by Research Centres (in thousands of dollars)

ARIO Property - Research Centres	Revenue	Expenses	Results	Budget	Balance
Alma	**(188)**	**740**	**552**	**657**	**105**
Ontario Aquaculture Research Centre	(188)	740	552	657	**105**
Arkell	**(192)**	**2,175**	**1,982**	**1,958**	**(24)**
Equine Research Facility	0	303	303	286	**(16)**
Feed Mill Facility	0	64	64	74	**9**
Ontario Poultry Research Centre	(190)	679	489	491	**2**
Swine Research Facility	(3)	1,128	1,126	1,107	**(19)**
Bradford	**(33)**	**306**	**273**	**293**	**19**
Ontario Crops Research Centre	(33)	306	273	293	**19**
Cedar Springs	**0**	**49**	**49**	**47**	**(2)**
Ontario Crops Research Centre	0	49	49	47	**(2)**
Elora	**(2,031)**	**4,396**	**2,365**	**2,277**	**(88)**
Ontario Beef Research Centre	(6)	1,142	1,136	1,127	**(10)**
Ontario Crops Research Centre	(10)	396	386	376	**(10)**
Ontario Dairy Research Centre	(2,015)	2,858	843	774	**(69)**
Emo	**(15)**	**58**	**43**	**44**	**1**
Ontario Crops Research Centre	(15)	58	43	44	**1**
Guelph Research Station	**(8)**	**347**	**339**	**281**	**(58)**
Huron	**(70)**	**57**	**(14)**	**52**	**66**
Ontario Crops Research Centre	(70)	57	(14)	52	**66**
New Liskeard	**(131)**	**1,018**	**886**	**724**	**(162)**
General Station Operations	(3)	596	593	507	**(85)**
Ontario Beef Research Centre	(34)	284	251	176	**(75)**
Ontario Crops Research Centre	(95)	137	43	41	**(2)**
Ponsonby	**(1)**	**556**	**555**	**529**	**(26)**
General Animal Facility	0	237	237	230	**(8)**
Ontario Sheep Research Centre	(1)	319	318	300	**(18)**
Research Station Operations	**(728)**	**2,684**	**1,956**	**2,102**	**146**
Ridgetown	**(568)**	**2,268**	**1,700**	**1,835**	**134**
Beef Facility	(33)	23	(10)	(5)	**5**
Dairy Facility	(351)	387	36	15	**(20)**
General Campus Operations	(175)	1,809	1,634	1,791	**157**
Swine Facility	(9)	49	40	33	**(7)**
Simcoe	**(57)**	**987**	**930**	**816**	**(114)**
Ontario Crops Research Centre	(57)	987	930	816	**(114)**
University	**(105)**	**795**	**690**	**579**	**(112)**
Growth Facilities	(105)	359	254	191	**(63)**
Isolation Unit	0	436	436	387	**(49)**
Winchester	**(142)**	**375**	**233**	**220**	**(14)**
Ontario Crops Research Centre	(142)	375	233	220	**(14)**
Woodstock	**(180)**	**222**	**42**	**103**	**61**
Ontario Crops Research Centre	(180)	222	42	103	**61**
Total Research Centres	**(4,450)**	**17,034**	**12,584**	**12,517**	**(68)**

The Ontario Crops Research Centre - Huron had a surplus of $66K, with a positive variance of 61%. The majority of this was due to an error in a labour transfer cost entry which overstated the surplus by $40K. The error has been corrected in 2022/23. The remainder of the surplus was related to stronger than budgeted crop sales.

New Liskeard – General Station Operations had a deficit of $85K, with a negative variance of 17%. This was due to a lump sum termination payment, related to the restructuring at New Liskeard.

The Ontario Beef Research Centre – New Liskeard had a deficit of $75K, with a negative variance of 22%. The variance was related to a lack of revenue from beef sales, as the herd transitioned to Elora and the Alliance began the process of transitioning ownership of the animals from the Beef Farmers of Ontario.

The Ontario Sheep Research Centre had a deficit of $18K, with a negative variance of 6%. This was due to higher than normal feed costs, as well as some temporary additional staffing costs.

Research Station Operations had a surplus of $146K, with a positive variance of 6%. This was mainly from better than budgeted crop revenue. This revenue increase was partially offset by higher than normal input costs.

The Ridgetown Dairy Facility had a deficit of $20K, with a negative variance of 6%. The variance was also related to higher than expected feed costs.

Ridgetown - General Campus Operations had a surplus of $157K, with a positive variance of 8%. This was due to a number of factors, with the most significant ones being a hydro rebate of approximately $100K (net) and stronger than normal sales revenue.

The Ontario Crops Research Centre - Simcoe had a deficit of $114K, with a negative variance of 13%. This deficit was due to several factors, including: a significant increase in natural gas and gasoline costs; higher than normal maintenance costs; increased rental equipment costs; and lower than normal sales revenue. The University is working closely with the Research Centre Manager to address the budgetary challenges at Simcoe.

The University Growth Facilities had a deficit of $63K, with a negative variance of 22%. This was predominately due to investments in new control equipment, as noted in Table 2.47.

The University Isolation Unit had a deficit of $49K, with a negative variance of 13%. The deficit was related to higher staffing and operating costs than expected. The University is working closely with the Central Animal Facility Manager to ensure that it has appropriate budgets for the future.

Finally, the Ontario Crops Research Centre – Woodstock had a surplus of $61K, with a positive variance of 29%. This was due to a significant increase in revenue, related to providing additional services to Canada's Outdoor Farm Show and higher than anticipated crop revenue due to strong commodity prices.

Table 2.23 shows the revenues and expenditures directly related to ARIO and University Tenants.

Table 2.23: 2021/22 Financial Breakdown by Tenants (in thousands of dollars)

Tenant Type	Revenue	Expenses	Results	Budget	Balance
Tenants - ARIO					
Alfred	**(17)**	**253**	**236**	**250**	**14**
Elora/Arkell	**(17)**	**13**	**(4)**	**0**	**4**
Guelph	**(1)**	**1**	**(1)**	**0**	**1**
Kemptville	**(75)**	**75**	**0**	**0**	**0**
New Liskeard	**(89)**	**113**	**24**	**0**	**(24)**
Education Centre	(72)	99	27	0	(27)
OPP	(17)	14	(3)	0	3
Ridgetown	**(17)**	**17**	**0**	**0**	**0**
Simcoe	**(25)**	**25**	**0**	**0**	**0**
Vineland	**(6)**	**6**	**0**	**0**	**0**
Total Tenants - ARIO	**(248)**	**503**	**255**	**250**	**(5)**
Tenants - University					
New Liskeard	**(5)**	**18**	**12**	**0**	**(12)**
Research Station Operations	**(46)**	**67**	**21**	**0**	**(21)**
Ridgetown	**(18)**	**14**	**(5)**	**0**	**5**
Total Tenants - University	**(70)**	**98**	**28**	**0**	**(28)**
Total Tenants	**(317)**	**601**	**283**	**250**	**(33)**

Finally, Table 2.24 delivers a summary by property type, including Vineland. The total corresponds to the overall financial summary for the Property Management program.

Table 2.24: 2021/22 Financial Breakdown by Property Type (in thousands of dollars)

Property Type	Revenue	Expenses	Results	Budget	Balance
Research Centres	(4,450)	17,034	12,584	12,517	(68)
Tenants - ARIO	(248)	503	255	250	(5)
Tenants - University	(70)	98	28	0	(28)
Vineland	0	1,206	1,206	1,191	(15)
Other[5]	(809)	574	(236)	(311)	(75)
Total	**(5,576)**	**19,414**	**13,837**	**13,646**	**(191)**

[5] Other includes the Livestock Research Fund (LRF), the Veterinary Field Services account, and all other central management accounts.

2.3.5.2 Revenue from ARIO Properties

Table 2.25 provides a report on all revenues and recoveries resulting from the activities at the ARIO Properties, including the sales of farm products, rental revenues, and recoveries for research centre usage. It is presented by year over a five-year period.

Table 2.25: Research Centre Revenues and Recoveries by Year (in thousands of dollars)

Revenues and Recoveries	2017/18	2018/19	2019/20	2020/21	2021/22
Revenues (External)	**6,199**	**5,965**	**5,465**	**5,698**	**5,576**
Sales of Animals, Farm Products	4,777	4,600	4,266	4,669	4,888
Miscellaneous	102	183	215	192	240
Facility Rentals	1,319	1,182	985	837	448
Recoveries (Internal)	**786**	**893**	**963**	**758**	**1,076**
Sales (net) of Animals, Farm Products	40	151	202	101	292
Research Centre Fees	549	417	426	406	524
Facility Usage (net)	197	325	334	251	260
Total	**6,985**	**6,858**	**6,428**	**6,457**	**6,653**

There were two notable elements in the 2021/22 values. External Facility Rentals continued to decline, with a substantial drop over the past year. This was predominately due to the sale of the New Liskeard property and the transfer of the Kemptville Farm. Since both occurred part way through the year, another significant decrease is expected again in 2022/23. Internal Sales of Animals, Farm Products rebounded from its 2020/21 value. This was due mainly to an increase in the number of animals processed in the Meat Science Laboratory.

Table 2.26 provides the summarized revenues and recoveries by property type for 2021/22. In addition, Table 2.27 illustrates the revenues and recoveries by category for each of the Research Centres.

Table 2.26: 2021/22 Revenues and Recoveries by Property Type (in thousands of dollars)

Property Type	Sales	Misc.	Facility Rentals	Total Revenues (External)	Sales (net)	Res. Centre Fees	Facility Usage (net)	Total Recoveries (Internal)	Grand Total
Research Centres	4,197	122	131	**4,450**	58	524	260	**842**	**5,292**
Tenants - ARIO	0	0	248	**248**	0	0	0	**0**	**248**
Tenants – Univ.	0	0	70	**70**	0	0	0	**0**	**70**
Other	691	118	0	**809**	234	0	0	**234**	**1,044**
Total	**4,888**	**240**	**448**	**5,576**	**292**	**524**	**260**	**1,076**	**6,653**

Table 2.27: 2021/22 Revenue and Recoveries for the Research Centres (in thousands of dollars)

Research Centres	Sales	Misc.	Facility Rentals	Total Revenues (External)	Sales (net)	Research Centre Fees	Facility Usage (net)	Total Recoveries (Internal)	Grand Total
Alma	**175**	**13**	**0**	**188**	**1**	**1**	**0**	**2**	**190**
Ontario Aquaculture Research Centre	175	13	0	**188**	1	1	0	**2**	**190**
Arkell	**190**	**3**	**0**	**192**	**10**	**173**	**0**	**183**	**375**
Equine Research Facility	0	0	0	**0**	0	10	0	**10**	**10**
Ontario Poultry Research Centre	190	0	0	**190**	3	147	0	**151**	**340**
Swine Research Facility	0	3	0	**3**	6	16	0	**22**	**25**
Bradford	**15**	**18**	**0**	**33**	**0**	**8**	**0**	**8**	**42**
Ontario Crops Research Centre	15	18	0	**33**	0	8	0	**8**	**42**
Elora	**2,021**	**10**	**0**	**2,031**	**6**	**139**	**0**	**144**	**2,175**
Ontario Beef Research Centre	6	0	0	**6**	0	65	0	**65**	**71**
Ontario Crops Research Centre	0	10	0	**10**	0	24	0	**24**	**34**
Ontario Dairy Research Centre	2,015	0	0	**2,015**	6	50	0	**56**	**2,071**
Emo	**3**	**12**	**0**	**15**	**0**	**7**	**0**	**7**	**21**
Ontario Crops Research Centre	3	12	0	**15**	0	7	0	**7**	**21**
Guelph	**0**	**8**	**0**	**8**	**0**	**2**	**0**	**2**	**10**
Guelph Research Station	0	8	0	**8**	0	2	0	**2**	**10**
Huron	**55**	**0**	**16**	**70**	**0**	**0**	**0**	**0**	**70**
Ontario Crops Research Centre	55	0	16	**70**	0	0	0	**0**	**70**
New Liskeard	**103**	**28**	**0**	**131**	**0**	**72**	**0**	**72**	**203**
General	0	3	0	**3**	0	0	0	**0**	**3**
Ontario Beef Research Centre	16	18	0	**34**	0	2	0	**2**	**36**
Ontario Crops Research Centre	87	7	0	**95**	0	70	0	**70**	**164**
Ponsonby	**1**	**0**	**0**	**1**	**10**	**13**	**0**	**24**	**25**
General Animal Facility	0	0	0	**0**	9	12	0	**21**	**21**
Ontario Sheep Research Centre	1	0	0	**1**	1	1	0	**3**	**4**
Research Station Operations	**717**	**11**	**0**	**728**	**25**	**0**	**0**	**25**	**753**
Ridgetown	**568**	**0**	**0**	**568**	**6**	**0**	**0**	**6**	**574**
Beef Facility	33	0	0	**33**	0	0	0	**0**	**33**
Dairy Facility	351	0	0	**351**	1	0	0	**1**	**352**

Research Centres	Sales	Misc.	Facility Rentals	Total Revenues (External)	Sales (net)	Research Centre Fees	Facility Usage (net)	Total Recoveries (Internal)	Grand Total
General	175	0	0	**175**	5	0	0	**5**	**180**
Swine Facility	9	0	0	**9**	0	0	0	**0**	**9**
Simcoe	**47**	**0**	**10**	**57**	**0**	**19**	**7**	**26**	**83**
Ontario Crops Research Centre	47	0	10	**57**	0	19	7	**26**	**83**
University	**0**	**0**	**105**	**105**	**0**	**37**	**254**	**290**	**395**
Growth Facilities	0	0	105	**105**	0	0	201	**201**	**306**
Isolation Unit	0	0	0	**0**	0	37	52	**89**	**89**
Winchester	**123**	**18**	**0**	**142**	**0**	**43**	**0**	**43**	**185**
Ontario Crops Research Centre	123	18	0	**142**	0	43	0	**43**	**185**
Woodstock	**180**	**0**	**0**	**180**	**0**	**10**	**0**	**10**	**190**
Ontario Crops Research Centre	180	0	0	**180**	0	10	0	**10**	**190**
Total	**4,197**	**122**	**131**	**4,450**	**58**	**524**	**260**	**842**	**5,292**

2.4 Agreement Fund Balances

2.4.1 Agreement Carry Forward Funds

Table 2.28 shows the Committed and Uncommitted Agreement Carry Forward Funds. On April 30, 2022, there were $28,513K in Committed Carry Forward Funds and $6,521K in Uncommitted Carry Forward Funds, for a total Carry Forward of $35,033K.

Table 2.28: Agreement Carry Forward Funds (in thousands of dollars)

Program	Carry Forward, May 1, 2021	2021/22 Results	Carry Forward, April 30, 2022
Research Program	21,063	397	21,460
Veterinary Capacity Program	7	(9)	(2)
Animal Health Laboratory	5,170	25	5,194
Agriculture and Food Laboratory	1,030	530	1,560
Property Management Program	491	(191)	300
Total Committed Funds	**27,761**	**751**	**28,513**
General and Inflation Reserve	11,075	(4,554)	6,521
Exigency Fund (Recognized)	0	0	0
Total Uncommitted Funds	**11,075**	**(4,554)**	**6,521**
Total OMAFRA Agreement Carry Forward Funds	**38,837**	**(3,803)**	**35,033**

2.4.2 Agreement Account

The University receives and holds quarterly cash advances for the Agreement on the provincial year basis. The cash balances are drawn down, as expenses for each month are processed, net of any program revenues received. The monthly cash balance is then credited with interest, per the Agreement. The amount of cash held is reported in the notes of the Quarterly Financial Reports and in the Audited Financial Statements. The balance in the Agreement Account on April 30, 2022 was $30,432K, as shown in Table 2.29.

Table 2.29 also provides the estimated Agreement Account balance to the end of the current Agreement, based on the expected budgeted net agreement (as per the 2022/23 Business Plan) and the estimated change in committed carry forward (updated as of April 30, 2022).

Table 2.29: Balance in the Agreement Account (in thousands of dollars)

Fiscal Year	Opening Balance, May 1	Advances	Budgeted Net Expenses	Net Agreement	Change in Committed Carry Forward	Total Change	Ending Balance, April 30
2018/19 (actual)	35,242	71,300	69,310	1,990	524	2,514	**37,756**
2019/20 (actual)	37,468	66,100	70,317	(4,217)	1,399	(2,818)	**34,651**
2020/21 (actual)	34,651	82,625	70,479	12,146	3,963	16,109	**50,760**
2021/22 (actual)	50,760	49,575	70,654	(21,079)	751	(20,328)	**30,432**
2022/23 (estimate)	30,432	66,100	71,318	(5,218)	(4,150)	(9,369)	**21,064**

It is important to note that there is a difference in the total cash balance in the Agreement Account compared to the total carry forward balance, which is a result of the quarterly advances being received for the provincial

year (April 1 to March 31) and the approved budget expenditures recorded on the University's fiscal year (May 1 to April 30). The timing difference between the budget carry forward and the cash account typically approximates one month of net budget. If the Agreement were to be terminated, the cash would run out at the provincial year end, one month before the University's fiscal year end, on which these figures are based.

Finally, unspent revenue, as per Note 3 of the Audited Financial Statements included in Appendix A, is the sum of the balances in the Agreement Account and the Exigency Fund.

2.4.2.1 Interest Earned on Agreement Account

The University allocates the Agreement interest based on the monthly cash balance in the Agreement Account at the 91 Day Treasury Index Rate. The interest is held in the Exigency Fund which is part of the Uncommitted Central Reserve.

Due to an accounting change in 2019/20, interest is no longer being recognized when it is allocated. Therefore, it does not appear in the Agreement Financial Summary. Instead, it is accrued and reported in a separate account (Exigency Fund). Revenue recognition of the interest will occur when the Executive Committee approves expenditures related to its use.

Table 2.30 summarizes the interest earned for 2021/22, as well as provides an estimate of interest for the last year of the Agreement. COVID-19 significantly impacted interest rates over the last two fiscal years. In the last quarter of 2021/22, interest rates began to rise, a trend which is expected to continue into 2022/23.

Table 2.30: Interest Earned on the Agreement Account (in thousands of dollars)

Fiscal Year	Average Monthly Cash Balance	Average Interest Rate	Interest
2018/19 (actual)	36,499	1.62%	629
2019/20 (actual)	34,297	1.47%	529
2020/21 (actual)	39,813	0.12%	47
2021/22 (actual)	37,839	0.32%	121
2022/23 (estimate)	30,866	1.20%	370

2.4.3 Uncommitted Central Reserve

The Uncommitted Central Reserve quantifies the total value of uncommitted funds, held centrally, within the overall Agreement. It includes funds held in the General and Inflation Reserve and in the Exigency Fund. Table 2.31 illustrates the balance in the Uncommitted Central Reserve. On April 30, 2022, the balance was $7,499K. It is expected to fall to $2,651K at the end of 2022/23.

Table 2.31: Uncommitted Central Reserve (in thousands of dollars)

Fiscal Year	General and Inflation Reserve, April 30	Exigency Fund, April 30	Total, April 30
2018/19 (actual)	19,670	287	**19,958**
2019/20 (actual)	15,454	810	**16,264**
2020/21 (actual)	11,075	857	**11,932**
2021/22 (actual)	6,521	978	**7,499**
2022/23 (estimate)	1,303	1,348	2,651

2.4.3.1 General and Inflation Reserve

The General and Inflation Reserve is comprised of uncommitted carry forward funds, predominately accrued over the term of the Previous Agreement, held centrally within the Agreement Account. Currently, the funds are being utilized to cover the deficit between the Annual Maximum Funds (Revenue) and amounts allocated to the Programs (Net Expenses).

Table 2.32 provides the balance in the General and Inflation Reserve. With the budgets identified in the 2022/23 Business Plan and assuming no other changes, the General and Inflation Reserve is expected to fall to $1,303K at the end of 2022/23.

Table 2.32: General and Inflation Reserve (in thousands of dollars)

Fiscal Year	Opening Balance, May 1	Budgeted Revenue	Budgeted Net Expenses	Budgeted Net Agreement	Ending Balance, April 30
2018/19 (actual)	17,680	71,300	69,310	1,990	**19,670**
2019/20 (actual)	19,670	66,100	70,317	(4,217)	**15,454**
2020/21 (actual)	15,454	66,100	70,479	(4,379)	**11,075**
2021/22 (actual)	11,075	66,100	70,654	(4,554)	**6,521**
2022/23 (estimate)	6,521	66,100	71,318	(5,218)	**1,303**

2.4.3.2 Exigency Fund

The Exigency Fund is comprised of funds held separately from the Agreement Account, which are the result of investment income earned and accumulated on the average monthly cash balances in the Agreement Account. It is expected to be used for the purposes as directed and approved by the Executive Committee.

Table 2.33 illustrates the balances in the Exigency Fund on April 30, 2022, and beyond. Assuming interest rates continue to act as predicted, the Exigency Fund is anticipated to grow to $1,348K at the end of 2022/23. At this point in time, there are no anticipated or approved expenditures from the Exigency Fund.

Table 2.33: Exigency Fund (in thousands of dollars)

Fiscal Year	Opening Balance, May 1	Interest Allocated	Approved Expenses	Change	Ending Balance, April 30
2018/19 (actual)	0	629	342	287	**287**
2019/20 (actual)	287	529	6	523	**810**
2020/21 (actual)	810	47	0	47	**857**
2021/22 (actual)	857	121	0	121	**978**
2022/23 (estimate)	978	370	0	370	**1,348**

2.5 Costs of Research Projects

Research Project costs, both spent and committed, are presented in the sections below by program activity.

2.5.1 Research Project Operating – Tier I

Table 2.34 shows the final division of the Research Project Operating budget into the Tier I, Special Initiatives, and Undergraduate Student Experiential Learning (USEL) programs for 2021/22.

Table 2.34: Division of the Research Project Operating Budget (in thousands of dollars)

Research Project Operating Components	2021/22 Budget Distribution
Tier I Projects	6,660
Special Initiatives Projects	1,000
USEL Program	115
Total	**7,775**

In addition to the operating budget of $6,660K for Tier I Projects, $301K was added from Research Project Operating unallocated funds, bringing the final 2021/22 budget for Tier I Projects to $6,961K. This provided funding for 49 projects over eight research priority areas. Table 2.35 shows the breakdown by research priority area.

Table 2.35: Research Project Operating -Tier I Budget

Research Priority Area	Number of Projects	2021/22 Budget
Animal Health & Welfare	18	$2,048,686
Competitive Production Systems	10	$1,564,434
Innovative Products & Product Improvement	3	$523,300
Plant Health & Protection	5	$742,060
Soil Health	4	$591,500
Strong Rural Communities	2	$330,804
Sustainable Production Systems	4	$575,400
Water Quality & Quantity	3	$585,158
Total	**49**	**$6,961,342**

Table 2.36 illustrates the amount spent in 2021/22 by research priority area/theme, the balance in the project accounts, and the amounts committed to future years.

Table 2.36: Research Project Operating - Tier I Financial Details (in thousands of dollars)

Year 4 - 2021/22	Previous Results	2021/22 Results	Balance in Project Accounts	Committed to Future Years	Total	Number of Projects Awarded	Number of Projects Completed
2021/22 Projects	**0**	**1,057**	**1,085**	**4,518**	**6,660**	**49**	**0**
Animal Health & Welfare		224	645	1,180	**2,049**	18	
Competitive Production Systems		363	15	1,186	**1,564**	10	
Innovative Products & Product Improv.		101	59	363	**523**	3	
Plant Health & Protection		162	67	513	**742**	5	
Soil Health		152	94	346	**592**	4	
Strong Rural Communities		184	3	144	**331**	2	
Sustainable Production Systems		66	83	426	**575**	4	
Water Quality & Quantity		106	119	360	**585**	3	
Unallocated		(301)		0	**(301)**		
2020/21 Projects	**728**	**1,885**	**1,469**	**2,990**	**7,073**	**50**	**3**
Animal Health & Welfare	151	342	685	684	**1,862**	15	
Competitive Production Systems	115	291	353	714	**1,472**	11	1
Food Safety	0	48	11	0	**59**	1	
Plant Health & Protection	259	288	(16)	370	**900**	6	
Productive Land Capacity	21	61	72	127	**281**	2	
Soil Health	8	6	66	130	**210**	1	
Sustainable Production Systems	148	461	211	772	**1,591**	12	2
Water Quality & Quantity	28	82	88	193	**392**	2	
Unallocated		307		0	**307**		
2019/20 Projects	**2,486**	**1,641**	**848**	**814**	**5,788**	**48**	**10**
Agri-Food and Rural Policy	216	102	229	0	**547**	6	1
Bioeconomy – Industrial Uses	372	233	(34)	205	**776**	6	1
Emergency Management	94	42	80	24	**240**	4	
Environmental Sustainability	513	402	162	444	**1,520**	7	1
Food for Health	0				**0**	0	
Products and Value Chains	126	84	69	39	**318**	2	
Production Systems - Animals	537	267	55	28	**888**	11	4
Production Systems - Plants	628	503	287	74	**1,491**	12	3
Unallocated		7		0	**7**		

Year 4 - 2021/22	Previous Results	2021/22 Results	Balance in Project Accounts	Committed to Future Years	Total	Number of Projects Awarded	Number of Projects Completed
2018/19 Projects	**4,372**	**1,122**	**489**	**0**	**5,983**	**54**	**31**
Agri-Food and Rural Policy	653	104	86		**843**	8.0	4.0
Bioeconomy – Industrial Uses	521	238	136		**896**	6.3	2.3
Emergency Management	164	(0)	0		**164**	2.3	1.8
Environmental Sustainability	644	170	75		**889**	7.0	3.0
Food for Health	336	117	69		**522**	4.0	1.0
Products and Value Chains	382	105	77		**565**	3.0	0.0
Production Systems - Animals	618	54	45		**718**	12.5	8.0
Production Systems - Plants	879	136	0		**1,015**	11.0	11.0
Unallocated	175	196		0	**371**		
Subtotal - Current Agreement	**7,586**	**5,704**	**3,891**	**8,322**	**25,504**	**201**	**44**
Previous Agreement					**(12,585)**		
Agri-Food and Rural Policy	1,613	79	208		**1,901**	8.0	2.0
Bioeconomy – Industrial Uses	1,113	66	17		**1,196**	3.7	3.0
Emergency Management	976	16	40		**1,031**	7.5	7.0
Environmental Sustainability	1,276	81	65		**1,422**	4.8	1.0
Food for Health	987	39	100		**1,126**	3.5	1.0
Products and Value Chains	997	53	33		**1,083**	5.5	5.0
Production Systems - Animals	2,090	212	58		**2,360**	9.0	6.0
Production Systems - Plants	1,893	68	49		**2,010**	4.0	1.0
Unallocated	230	228		0	**457**		
Subtotal - Other	**11,176**	**841**	**568**	**0**	**0**	**46**	**26**
Grand Total	**18,762**	**6,545**	**4,459**	**8,322**	**25,504**	**247**	**70**

Table 2.36 illustrates the budgeted amount awarded by year in the current Agreement ($6,660K in 2021/22, $7,073K in 2020/21, $5,788K in 2019/20 and $5,983K in 2018/19) and how those funds are currently distributed (spent, in project accounts, or committed to future years of the project (held in the Office of Research Agri-Food Partnership)). It also shows the total spending for 2021/22 ($6,545K) which is consistent with the results for the Research Project Operating – Tier I program activity in Table 2.9. Within the Research Project Operating – Tier I, there are currently no unallocated funds (i.e., all Unallocated lines are showing $0 in the Committed to Future Years Column), as they have been moved to Research Project Operating - Special Initiatives during 2021/22. Finally, the carry forward can be determined by combining the balance in the project accounts with the amounts committed to future years. For Tier I Projects, the carry forward is $12,782K ($4,459K + $8,322K), which also matches Table 2.9.

Table 2.36 also identifies the Number of Projects Awarded. This is accurate for projects within the Current Agreement. For projects from the Previous Agreement, it represents the number of projects that were active in 2021/22. The count can be a fractional number as researchers were allowed to divide their project across research themes. In 2019/20, researchers were asked to pick a primary theme and thus, projects were no longer split. The Number of Projects Completed identifies the cumulative total number of projects from that call cycle that have been completed/ended in 2021/22. It is based on the projects' current end date.

The tables in the following sections can be read in a similar fashion. Several of them contain an "Inter-Year Project Adjustment". This adjustment relates to the timing differential in spending compared to the budget allocations. A positive adjustment indicates an underspend related to budget, while a negative adjustment shows an overspend related to budget. These will approach zero by the completion of the Agreement, as demonstrated in the Business Plan. There is no Inter-Year Project Adjustment for Research Project Operating – Tier I, as the under/overspend is recorded in Research Project Operating – Special Initiatives each year.

2.5.2 Research Project Operating – Special Initiatives

The final Special Initiatives budget for 2021/22 was $1,000K. Two new Special Initiatives projects were approved in 2021/22, along with four existing projects that received funded amendments, totalling $845K. In addition, $50K was set aside to support the Research Centre Access Fee Subsidy. This leaves a cumulative balance at the end of 2021/22 in the Research Project Operating – Special Initiatives activity of $93K (2021/22 Inter-Year Project Adjustment).

Table 2.37 shows the amount spent in 2021/22 by activity, the balance in the project accounts, and the amounts committed to future years.

Table 2.37: Research Project Operating - Special Initiatives Financial Details (in thousands of dollars)

Year 4 - 2021/22	Previous Results	2021/22 Results	Balance in Project Accounts	Committed to Future Years	Adjustments	Total	Number of Projects Awarded	Number of Projects Completed
2021/22 Projects	**0**	**0**	**111**	**169**	**565**	**845**	**2**	**0**
Projects		0	111	169		**280**	2	
Amendments (other years)					565	**565**		
2020/21 Projects	**216**	**487**	**108**	**1,047**	**(131)**	**1,727**	**14**	**1**
Projects	174	464	90	1,045	(45)	**1,727**	12 (+1 on hold)	1
Out of Cycle	43	23	19	2	(86)	**(0)**	1	
2019/20 Projects	**339**	**295**	**(5)**	**1,179**	**(362)**	**1,447**	**11**	**2**
Projects	339	295	(5)	1,178	(362)	**1,447**	11	2
Unallocated				0		**0**		
2018/19 Projects	**199**	**144**	**106**	**200**	**(350)**	**300**	**1**	**0**
Projects	199	144	106	200	(350)	**300**	1	
Inter-year Project Adjustment				93		**93**		
Research Centre Access Fee Subsidy				50		**50**		
Impact Case Study	180	35	110	0		**325**		
Unallocated	(566)	(436)		723	278	**0**		
Subtotal - Current Agreement	**370**	**526**	**431**	**3,460**	**0**	**4,786**	**28**	**3**
Other Projects (non-Agreement)	0	0	0	0	0	**0**	2	2
Subtotal - Other	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**2**
Grand Total	**370**	**526**	**431**	**3,460**	**0**	**4,786**	**30**	**5**

There were $429K in unallocated funds available on April 30, 2021. Throughout 2021/22, $802K of unallocated funds were added from the Research Project Operating – Tier I activity. From these funds, there were $508K in commitments actioned in 2021/22, leaving a balance of $723K on April 30, 2022. Funds were also committed to two waitlisted 2022/23 Tier I Projects, leaving a balance of $320K available, as of June 30, 2022. These funds will be reallocated to new projects in the coming year, used to support amendments, or reinvested into the next Agreement.

Table 2.38 shows the approved usage of the unallocated funds.

Table 2.38: Approved Usage of the Unallocated Funds within the Research Project Operating - Special Initiatives (in thousands of dollars)

Item	**Total**
Unallocated Funds, as of April 30, 2021	429
Unallocated Funds, added during 2021/22	802
Total Unallocated Funds Available	**1,231**
COVID-19 Project Support	64
2019/20 Tier I Project Amendment - UofG2018-3196 (Gillespie), approved by R/PM PMC on December 15, 2020	22
2017/18 Tier I Project Amendment - UofG2016-2732 (Grodzinski), approved by R/PM PMC on January 8, 2021	22
2018/19 Tier I Project Amendment - UofG2017-2971 (Jordan), approved by R/PM PMC on August 26, 2021	20
2021/22 Tier I Project - UG-T1-2021-100944 (Lauzon), approved by R/PM PMC on May 31, 2021	133
2021/22 Tier I Project - UG-T1-2021-101114 (Mohanty), approved by R/PM PMC on May 31, 2021 ($227K less balance in remaining in 2021/22 Tier I budget $58K)	169
Project Amendment - UG-SI-2019-100161 (Van Heyst), approved by R/PM PMC on August 26, 2021	142
Total Allocations Actioned in 2021/22	**508**
Balance, as of April 30, 2022	**723**
2022/23 Tier I Project - UG-T1-2022-101682 (Joye), approved by EC on March 2, 2022 (recommend if funding available)	165
2022/23 Tier I Project - UG-T1-2022-101714 (Gordon), approved by EC on March 2, 2022 (recommend if funding available) ($239K less balance in remaining in 2022/23 Tier I budget $1K)	238
Total Other Approved Allocations, to be Actioned in 2022/23	**404**
Balance, as of June 30, 2022	**320**

2.5.3 Highly Qualified Personnel Scholarship Program

The Highly Qualified Personnel (HQP) Scholarship Program has a net activity budget of $250K per year. This amount must be matched by the University of Guelph from third-party funds. Thus, the total value of scholarships awarded is expected to be $500K per year. The expenditures related to each scholarship occur over one to four years, with the matching funds being recorded over the same time frame.

In 2021/22, the University was able to award an additional $70K in scholarship support, beyond the required matching funds, through a strategic collaboration with the Canada First Research Excellence Fund (CFREF) Food from Thought project. Table 2.39 shows the financial details related to the HQP Scholarship Program. There were 14 scholarships awarded this year. The actual expenditures in 2021/22, related to awards from the current Agreement, were $832K. This generated $559K in matching funds from Food from Thought. There were also $209K (net) committed to future scholarship payments. In addition, in 2021/22, the Alliance provided COVID-19 support payments totalling $44K to six students.

Table 2.39: HQP Scholarship Program Financial Details (in thousands of dollars)

Year 4 - 2021/22	Previous Results	2021/22 Results	Committed to Future Years	Total	Number of Scholarships Awarded	Number of Scholarships Completed
2021/22 Award Winners	0	297	273	**570**	14	4
2020/21 Award Winners	330	382	252	**963**	19	9
2019/20 Award Winners	700	153	67	**920**	20	16
2018/19 Award Winners	501	0	0	**501**	12	12
Matching Requirement	(1,008)	(559)	(387)	**(1,954)**		
COVID-19 Support	12	44	0	**56**		
Unallocated	(29)	(31)	4	**(56)**		
Subtotal - Current Agreement	**506**	**285**	**209**	**1,000**	**65**	**41**
Previous Agreement	(256)			**(256)**		
Previous Award Winners	239			**239**	5	5
COVID-19 Support	28			**28**		
Unallocated	(11)			**(11)**		
Subtotal - Other	**0**	**0**	**0**	**0**	**5**	**5**
Grand Total	**506**	**285**	**209**	**1,000**	**70**	**46**

2.5.4 Gryphon's LAAIR

The Gryphon's LAAIR budget is fixed at $400K per year and includes funding for an event, as well as project-based activities. Table 2.40 shows the amount spent in 2021/22 by activity, the balance in the project accounts, and the amounts committed to future years. In 2021/22, two Market Validation projects with a total funding of $40K, and four Product Development projects with a total funding of $373K, were awarded. Within Gryphon's LAAIR, there are currently $2K in unallocated funds (net) and, with the 2022/23 awards approved in February 2022, another $45K unawarded, for a total of $47K available. There are also $58K in available funds related to the Impact Pitch Event.

Table 2.40: Gryphon's LAAIR Financial Details (in thousands of dollars)

Year 4 - 2021/22	Previous Results	2021/22 Results	Balance in Project Accounts	Committed to Future Years	Total	Number of Projects Awarded	Number of Projects Completed
2021/22 Projects		**181**	**46**	**185**	**412**	**6**	**0**
Market Validation		36	4	0	**40**	2	0
Product Development		145	42	185	**373**	4	0
2020/21 Projects	**95**	**99**	**66**	**40**	**300**	**4**	**1**
Market Validation	18	2	(0)	0	**20**	1	1
Product Development	77	97	66	40	**280**	3	0
2019/20 Projects	**260**	**80**	**15**	**85**	**440**	**10**	**8**
Market Validation	98	19	6	0	**124**	7	6
Product Development	162	60	9	0	**231**	3	2
Unallocated				85	**85**		
2018/19 Projects	**290**	**21**	**19**	**4**	**334**	**9**	**7**
Market Validation	98	(0)	19	0	**116**	6	5
Product Development	192	22	0	0	**214**	3	2
Unallocated				4	**4**		
Inter-year Project Adjustment				(86)	**(86)**		
Impact Pitch Event	108	34	58		**200**		
Subtotal - Current Agreement	**753**	**415**	**204**	**227**	**1,600**	**29**	**16**
Unallocated	(0)			0	**0**		
Subtotal - Other	**(0)**	**0**	**0**	**0**	**0**	**0**	**0**
Grand Total	**753**	**415**	**204**	**227**	**1,600**	**29**	**16**

2.5.5 Knowledge Translation and Transfer Program

The Knowledge Translation and Transfer (KTT) budget is fixed at $500K per year and includes allocations for the Agri-Food and Rural Link program, the KTT Funding program and KTT Initiative projects. Table 2.41 shows the amount spent in 2021/22 by activity, the balance in the project accounts, and the amounts committed to future years. In 2021/22, four Mobilization projects with a total funding of $155K, and two Research projects with a total funding of $131K, were awarded. In addition, one new KTT Initiative project was funded. Within the KTT Funding program, there are currently $13K in unallocated funds (funds returned from projects) and, with the 2022/23 awards approved in February 2022, $54K in unawarded funds, for a total of $67K available. There are also $76K in unawarded funds in the KTT Initiative projects.

Table 2.41: KTT Program Financial Details (in thousands of dollars)

Year 4 - 2021/22	Previous Results	2021/22 Results	Balance in Project Accounts	Committed to Future Years	Total	Number of Projects Awarded	Number of Projects Completed
2021/22 Projects	**0**	**59**	**84**	**142**	**285**	**6**	**0**
Mobilization		41	37	76	**155**	4	0
Research		18	47	66	**131**	2	0
2020/21 Projects	**48**	**94**	**142**	**51**	**336**	**9**	**2**
Mobilization	34	68	113	51	**266**	8	2
Research	14	27	29	0	**70**	1	0
2019/20 Projects	**224**	**106**	**71**	**2**	**402**	**10**	**4**
Mobilization	124	73	15	2	**213**	6	3
Research	100	32	57	0	**189**	4	1
Unallocated	0	0	0	0	**0**		
KTT Initiative Projects	**20**	**13**	**1**	**76**	**110**	**10**	**9**
2021/22		5	0	15	**20**	1	1
2020/21	3	2	1	24	**30**	2	1
2019/20	15	7	0	8	**30**	6	6
2018/19	2		0	28	**30**	1	1
Inter-Year Project Adjustment	0			106	**106**		
Agri-Food and Rural Link	498	180	82		**760**		
Subtotal - Current Agreement	**790**	**452**	**382**	**377**	**2,000**	**35**	**15**
Unallocated	(13)			13	**0**		
Subtotal - Other	**(13)**	**0**	**0**	**13**	**0**	**0**	**0**
Grand Total	**777**	**452**	**382**	**390**	**2,000**	**35**	**15**

2.6 ARIO Properties - Special Projects

Information about special projects, such as major renovations, repairs or capital projects/needs of ARIO Properties can be found in Section 7.1.

2.7 Allocation of Shared Services for the Laboratory Services Division

Table 2.42 shows the allocation of shared services for the Laboratory Services Division (LSD) including a breakdown by laboratory.

Table 2.42: 2021/22 Allocation of Shared Services for LSD (in thousands of dollars)

Area	Total	AHL %	AHL Amount	AFL %	AFL Amount
Human Resources	187	50%	94	50%	94
Facility Management	851	25%	213	75%	638
Sample Reception	351	5%	18	95%	334
Information Technology	1,160	63%	728	37%	433
Business Development	207	0%	-	100%	207
Sales	(20)	0%	-	100%	(20)
Customs	1	50%	1	50%	1
Finance	585	50%	293	50%	293
Co-Executive Directors' Offices	16	50%	8	50%	8
Quality Assurance	616	50%	308	50%	308
Staff Activities	(1)	0%	-	100%	(1)
Reinvestments	(4)	0%	-	100%	(4)
Total	**3,952**		**1,661**		**2,290**

2.8 Summary of Third-Party Funding Obtained

Third-party funding and revenues generated by the University in support of the Programs under this Agreement are critical for ensuring that enough capacity exists so that the Alliance is successful in developing solutions to real-world agri-food issues. Table 2.43 provides a summary of third-party funding and revenues in 2021/22. The University was able to leverage the province's $66.1M investment, attracting $86.3M in third-party funding and revenue.

Table 2.43: 2021/22 Summary of Third-Party Funding and Revenue (in thousands of dollars)

Program	Description	Total
Agriculture and Food Laboratory	Testing Revenue	8,968
Animal Health Laboratory	Testing Revenue	8,525
Property Management	Sales of Farm Products and Rental Revenues	5,576
Research Program	Miscellaneous Revenue	71
	Subtotal External Revenues	**23,140**
Agriculture and Food Laboratory	Internal Testing Revenue (net)	573
Animal Health Laboratory	Internal Testing Revenue (net)	1,624
Property Management	Internal Revenue for Animal Purchases, Growth Facility Usage and Research Centre Access Fees (net)	1,076
	Subtotal Internal Revenues (Recoveries from Outside of the Agreement)	**3,274**
Research Program	HQP Scholarship Program Matching (cash)	559
Research Program	HQP Scholarship Program Course Support	70
Research Program	Third-Party Funding for Research Projects (cash)	5,091
Research Program	Third-Party Funding for Tier II and III Projects	6,722
Research Program	Support for Data Initiatives	166
Research Program	External Research Dollars Awarded to the University related to Ministry Priorities[6]	47,163
Veterinary Capacity Program	Additional Support for VCP Doctoral Program Students (from donations)	105
	Subtotal Leverage Funding	**59,877**
	Total Third-Party Funding and Revenue	**86,291**

[6] The total value of External Research Dollars Awarded to the University related to Ministry Priorities is $61,869K. The HQP Scholarship Program Matching, HQP Scholarship Program Course Support, the Third-Party Funding for Research Projects, the Third-Party Funding for Tier II and III Projects, the Support for Data Initiatives and a portion of the Internal Recoveries are subsets of the External Research Dollars. To prevent double counting, the External Research Dollars have been reduced by those amounts. However, $1,177K of the Internal Testing Revenue in AHL is related to the Health Sciences Centre in OVC and is funded through the Ministry of Colleges and Universities (MCU). This is not included in the External Research Dollars and, therefore, has not been removed.

2.9 Asset Inventory Changes

Changes in the Asset Inventory for each program are described in the following sections. This includes purchases, sales, leases, and dispositions of assets with a value of $10K or more.

2.9.1 Research Program

Table 2.44 shows the asset inventory changes in the Research Program.

Table 2.44: 2021/22 Asset Inventory Changes for the Research Program (in thousands of dollars)

Lead Applicant, Project, Program and Location	Description	Amount	Action	Notes
B. Van Heyst, UG-T1-2021-101120, Tier I, Research Laboratory	DustTrak DRX Handheld Aerosol Monitor	14	Purchase	Equipment was noted in the project budget.

2.9.2 Veterinary Capacity Program

No assets with a value over $10K were purchased, sold, leased, or disposed of in 2021/22.

2.9.3 Animal Health Laboratory

Table 2.45 shows the asset inventory changes, over $10K, for the Animal Health Laboratory.

Table 2.45: 2021/22 Asset Inventory Changes for the Animal Health Laboratory (in thousands of dollars)

Area	Description	Amount	Action	Notes
Bacteriology	MALDI-TOF Sirius	345	Purchase	Purchase approved in the 2021/22 Business Plan.
Bacteriology	MALDI-TOF Sirius	345	Purchase	Purchase approved in the 2021/22 Business Plan for purchase in the 2022/23 fiscal year. The purchase was accelerated due to concerns about the existing equipment and the desire for faster, more reliable test results. This decision was approved by the AHL PMC on January 12, 2022.
Virology, Bacteriology, Molecular	Thermocyclers (4)	315	Purchase	Purchase approved by the AHL PMC on January 12, 2022. The thermocyclers will support ASF surge capacity and replace aging units.
Toxicology	Gas Chromatograph	232	Purchase	Purchase approved in the 2021/22 Business Plan for purchase in 2022/23. The purchase was accelerated due to concerns about the existing equipment. This decision was approved by the AHL PMC on January 12, 2022.
Bacteriology	BIOMIC V3	105	Purchase	Purchase approved by the AHL PMC on September 3, 2021. Software has become obsolete. New model is required to ensure continuity of service and quality control.
Bacteriology	Anaerobic Chamber	98	Purchase	Purchase approved by the AHL PMC on February 16, 2022. The equipment will replace a non-functional 10-year-old unit that is no longer maintaining appropriate environmental controls, and for which preventive maintenance is no longer available.
Histology	Leica Microtomes (2)	52	Purchase	Purchase approved by AHL PMC on October 4, 2021. The purchase will replace original equipment which has been deemed obsolete and cannot be repaired.
Toxicology	Microwave Digestor	48	Purchase	Purchase approved in the 2021/22 Business Plan.
Histology	AutoStainer XL	47	Purchase	Purchase approved in the 2021/22 Business Plan.

Area	Description	Amount	Action	Notes
Virology	Tissue Homogenizers	42	Purchase	Purchase approved by the AHL PMC on January 12, 2022. The existing homogenizers have been discontinued and are no longer be supported by a service contract.
Molecular Diagnostics	Fluorescent Microscope	36	Purchase	Purchase approved by the AHL PMC on January 12, 2022. The cost to repair the current aging model approaches the cost for complete replacement.
PM Room	Monorail Replacement	31	Purchase	Purchase approved in the 2020/21 Business Plan; however, the purchase was delayed due to COVID-19. The total cost is expected to be $41K, with the remaining $10K to be expensed in 2022/23.
Virology	iSeq 100	26	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.
Pathology	Upgrade to HMI/PLC Package for Digester	25	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.
AHL Room 2815	Mechanical Electrical Upgrade	24	Purchase	Purchase approved by the AHL PMC on January 12, 2022. This is required to support the thermocyclers. The total cost is expected to be $50K, with the remaining $26K to be expensed in 2022/23.
Virology	Two Block Thermocyclers	23	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.
PM Room	Biosafety Cabinets	20	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.
Virology	Freezers	19	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.
Mycoplasmology	Ergonomic Microscope	15	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.
Bacteriology, Molecular, Parasitology	Passthrough Refrigerator	15	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.
Virology	Centrifuge and Adapter	15	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.
Histotechnology	Transfer station	13	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.

2.9.4 Agriculture and Food Laboratory

Table 2.46 shows the asset inventory changes, over $10K, for the Agriculture and Food Laboratory.

Table 2.46: 2021/22 Asset Inventory Changes for the Agriculture and Food Laboratory
(in thousands of dollars)

Area	Description	Amount	Action	Notes
Dairy	Milkoscan / SCC Instruments	615	Purchase	Purchase approved in the 2021/22 Business Plan. This is a replacement for a key instrument used for composition and somatic cell count testing for dairy.
Food Microbiology	Hydraulic Stand and Biosafety Cabinets	49	Purchase	Purchase approved in the 2021/22 Business Plan.
Chemistry	Upgrade AB Sciex 5500	38	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.
Facility	Alsident Fume Extractor Arm System	35	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.
Molecular Super Centre	Liquid Handling Robot	31	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.
Chemistry	Geno Grinder & Foam Centrifuge Tube Holder	22	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.
Chemistry	Hydraulic Stand	16	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.
Molecular Super Centre	Mi Seq Control Software	13	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.
Chemistry	Refrigerator for Flammable Storage	10	Purchase	Purchase approved in the Business Plan under “Miscellaneous Items”.

2.9.5 Property Management Program

Table 2.47 shows the asset inventory changes in the Property Management Program.

Table 2.47: 2021/22 Asset Inventory Changes for the Property Management Program
(in thousands of dollars)

ARIO Property	Description	Amount	Action	Notes
Plant Agriculture Growth Facilities	ARGUS Titan Control Equipment	58	Purchase	Approved on February 4, 2022 by R/PM PMC. Total cost is approximately $240K. Remainder of the cost will be expensed in 2022/23.

Table 2.48 provides the total asset value, value of acquisitions and value of dispositions for the ARIO Properties. Most equipment is purchased using ARIO Minor Capital funds and, thus, is not listed in Table 2.47. Actual inventory lists by ARIO Property are available on request.

Table 2.48: Total Asset Value, Acquisitions, and Dispositions for each of the ARIO Properties (in thousands of dollars)

ARIO Property	Opening Balance (May 1, 2021)	Acquisitions in 2021/22	Dispositions in 2021/22	Closing Balance (April 30, 2022)	Value for Dispositions
Alma - Ontario Aquaculture Research Centre	**456**	**45**	**37**	**464**	**0 (scrap)**
Arkell	**3,533**	**254**	**0**	**3,787**	
Equine Research Facility	37	0	0	37	
Feedmill Facility	832	0	0	832	
Ontario Poultry Research Centre	1,435	254	0	1,689	
Swine Research Facility	1,229	0	0	1,229	
Bradford - Ontario Crops Research Centre	**249**	**0**	**0**	**249**	
Elora	**13,498**	**2,030**	**30**	**15,498**	
Ontario Beef Research Centre	5,295	2,030	0	7,325	
Ontario Crops Research Centre	3,042	0	30	3,012	10 (sold)
Ontario Dairy Research Centre	5,161	0	0	5,161	
Emo - Ontario Crops Research Centre	**70**	**0**	**0**	**70**	
Guelph Research Station	**236**	**0**	**29**	**207**	**7 (sold)**
New Liskeard Research Station	**1,182**	**32**	**132**	**1,082**	**16 (sold, transferred, scrap, and donated)**
Office of Research	**31**	**0**	**0**	**31**	
Ponsonby	**447**	**0**	**0**	**447**	
Dairy Facility	254	0	0	254	
General Animal Facility	117	0	0	117	
Ontario Sheep Research Centre	76	0	0	76	
Research Station Operations	**3,776**	**206**	**0**	**3,982**	
Ridgetown Campus	**6,047**	**77**	**130**	**5,993**	**0 (scrap)**
Simcoe - Ontario Crops Research Centre	**547**	**0**	**0**	**547**	
Vineland	**770**	**0**	**188**	**582**	**0 (scrap)**
Winchester - Ontario Crops Research Centre	**1,056**	**467**	**0**	**1,523**	
Woodstock - Ontario Crops Research Centre	**407**	**0**	**0**	**407**	
Total	**32,306**	**3,110**	**546**	**34,871**	

2.10 Non Salary Benefits

For the purposes of allocating Non Salary Benefits, the Ministry acknowledges that the University uses a pooled costing method, whereby all costs associated with an activity or cost type are aggregated and subsequently allocated to users of the activity or cost type using consistent methods or bases for all users.

Employer benefit costs for employees are charged to departments and programs using standard benefit allocation rates that are fixed for each fiscal year. Adjustments are not made to individual rates if they are relatively minor and reflect annual variances that are not considered structural or material in nature. Annual variances between recovered (allocated costs) and actual costs in the benefit cost pool are absorbed centrally to avoid relatively minor changes being made in the rates each year. Historically, these allocations have been very accurate, and the carry forward adjustment is relatively small.

Table 2.49 shows the Salary and Wages and Non Salary Benefits by Program for 2021/22.

Table 2.49: Salary and Wages and Non Salary Benefits by Program (in thousands of dollars)

Program	Salary and Wages	Non Salary Benefits
Research Program	10,693	2,002
Veterinary Capacity Program	175	29
Animal Health Laboratory	8,271	2,269
Agriculture and Food Laboratory	8,116	2,341
Property Management Program	8,201	2,173
Grand Total	**35,457**	**8,813**

Table 2.50 provides the total Salary and Wages, the Benefit Allocation Rate, and the Non Salary Benefits by Object Code.

Table 2.50: Salary and Wages and Non Salary Benefits by Object Code (in thousands of dollars)

Object Code	Salary and Wages	Benefit Allocation Rate	Non Salary Benefit Costs
61103-P&M - RFT	6,442	28.00%	1,804
61108-OVERTIME - RFT	440	6.50%	29
61109-SHIFT PREMIUMS - RFT	73	6.50%	5
61112-FACULTY - VETERINARIANS - RFT	2,213	23.25%	514
61130-USW - RFT	10,427	33.30%	3,472
61133-EXEMPT- RFT	30	28.00%	8
61134-HONORARIUMS (FULL TIME)	99	3.60%	4
61135-OSSTF - RFT	5,941	32.00%	1,901
61203-P&M - TFT	816	17.00%	139
61204-Grant Trust Admin Tech - TFT	1,092	15.70%	172
61205-Grant Trust Professional - TFT	665	17.00%	113
61207-SUPPORT STAFF - TFT UNREPRESENTED	7	15.70%	1
61210-SESSIONAL LECTURER - CUPE 3913	32	16.00%	5
61221-POST DOCTORAL - TFT	37	17.20%	6
61230-USW-TFT	924	15.70%	145
61234-HONORARIUMS TEMPORARY (PART TIME)	11	3.60%	0
61235-OSSTF - TFT	668	15.70%	105
61252-VETERINARIAN - TEMPORARY	156	16.05%	25
61253-CONTRACTUALLY LIMITED P&M	186	17.00%	32
61304-Grant Trust Admin Tech - TPT	182	14.70%	27
61307-SUPPORT STAFF - TPT UNREPRESENTED	362	14.70%	53
61335-OSSTF - TPT	110	14.70%	16
61417-STUDENT LABOUR - TPT	1,489	9.15%	136
61419-GRADUATE RESEARCH ASSISTANT	763	0.50%	4
61420-GRADUATE SERVICE ASSISTANT	152	8.25%	13
61431-GRA - DOCTORAL- DOMESTIC	298	0.50%	1
61435-GRA - MASTERS- DOMESTIC	745	0.50%	4
61436-GSA - MASTERS- DOMESTIC	21	8.25%	2
61438-GRA - DOCTORAL- FOREIGN	332	0.50%	2
61439-GSA - DOCTORAL- FOREIGN	1	8.25%	0
61441-GRA - MASTERS - FOREIGN	72	0.50%	0
61442-GSA - MASTERS - FOREIGN	2	8.25%	0
61443-POST DOCTORAL - DOMESTIC	160	17.20%	27
61444-POST DOCTORAL - FOREIGN	77	17.20%	13
61445-STUDENT LABOUR - UNDERGRAD – DOMES.	285	9.15%	26
61522-NON-UOFG PERSONNEL COST CHARGE	9	0.00%	0
61552-LUMP SUM PAYMENTS	139	various	8
Grand Total	**35,457**		**8,813**

2.11 Summary of Intellectual Property Costs

Intellectual Property (IP) costs, expenditures related to IP development and revenues are reported on separately by the Research Innovation Office (RIO) to ARIO.

2.12 Attestation by a Duly Authorized Signing Authority

I confirm that the University of Guelph has followed its internal financial controls when managing the OMAFRA-UofG Agreement.

_____

Mr. David Hargreaves
Associate Vice-President, Finance
University of Guelph

2.13 Audited Financial Statements

The financial statements were audited by Ernst & Young and are provided in Appendix A of this document.

3 RESEARCH PROGRAM

As described in the Agreement, the Research Program is responsible for developing and managing a research and innovation system that:

a) Sustains and generates new, core capacity needed to undertake world class research and scientific, economic and data analysis;
b) Maximizes the use of research infrastructure in a manner that provides benefits to all of Ontario's regions;
c) Informs evidence-based public policy and drives public awareness and fact-based dialogue;
d) Supports the commercialization of new technologies;
e) Fosters frequent and quality collaboration among the agri-food and rural research community, the University, the agri-food sector and rural Ontario; and
f) Increases access and sharing of data to facilitate new agri-food and rural research and data analytics to inform decision making.

The Agreement's Research Program achieves these goals by addressing the innovation continuum comprehensively, from funding market-driven innovative research, to mobilizing these research results into both the public domain and marketplace. Together with research partners along the continuum, the program delivers new knowledge and technologies that support industry competitiveness and provide positive social benefits, subsequently maximizing the return on public investment.

3.1 Program Activities and Achievements from 2021/22

Research Leadership

The University of Guelph leads the country in all of agriculture, agri-food, veterinary and rural sciences programs:

- UofG ranked first in Canada and fifth in the world for veterinary sciences.[7]
- UofG ranked first in Canada and twenty-first in the world for agricultural sciences.[8]
- UofG ranked first in Canada and twentieth in the world for food science and technology.[9]
- UofG ranked second among Canadian comprehensive universities in an annual national survey of top research institutions.[10]

[7] "QS World University Rankings by Subject 2022: Veterinary Science," QS Top Universities, accessed July 21, 2022, https://www.topuniversities.com/university-rankings/university-subject-rankings/2022/veterinary-science

[8] "Best Global Universities for Agricultural Sciences in Canada," U.S. News, accessed July 21, 2022, https://www.usnews.com/education/best-global-universities/canada/agricultural-sciences

[9] "Best Global Universities for Food Science and Technology," U.S. News, accessed July 21, 2022, https://www.usnews.com/education/best-global-universities/food-science-technology

[10] "UofG Retains Second Spot in Top Canadian Research University Rankings," University of Guelph News, University of Guelph, last modified January 25, 2022, https://news.uoguelph.ca/2022/01/u-of-g-retains-second-spot-in-top-canadian-research-university-rankings/

- UofG ranked first in the amount of research income it attracts from the private sector as a percentage of total research income, and first in research intensity per faculty member.[11]
- UofG ranked fourteenth in Canada for its scientific impact in all fields. For impact in life and earth sciences, UofG ranked third in Canada, and 47th in the world from a field of 1,104 universities.[12]
- UofG ranked sixteenth worldwide (fifth in Canada) in meeting the United Nations Sustainable Development Goals which include providing inclusive and equitable quality education, achieving gender equality and building sustainable cities and communities.[13]

The University of Guelph and four of its researchers in biological, veterinary, and agricultural sciences were among top ten leaders in the 2022 national and international rankings released by Research.com.[14] UofG placed among the top five Canadian universities in four ranked categories: ecology and evolution; plant science and agronomy; animal science and veterinary; and microbiology. Four faculty members placed among the top ten Canadian researchers in their respective fields, including Dr. Paul Hebert, Department of Integrative Biology within the College of Biological Science (CBS), who ranked second nationally and 49th globally in ecology and evolution – a new category in this year's rankings. In the category of animal science and veterinary, Dr. Ken Leslie, emeritus professor in the Department of Population Medicine within the Ontario Veterinary College (OVC), ranked fifth nationally and 15th worldwide. Population medicine professor Dr. Todd Duffield placed eighth in Canada and 36th globally in the same field. Dr. Clarence Swanton, emeritus professor in the Department of Plant Agriculture within the Ontario Agricultural College (OAC), ranked seventh in Canada and 244th worldwide in the category of plant science and agronomy.

In addition, UofG dairy cattle health researcher Dr. Stephen LeBlanc was once again named to the prestigious Clarivate Analytics list of "Highly Cited Researchers" for 2021.[15] This is the third time LeBlanc has been named to the list of international researchers who have demonstrated significant influence in their chosen field or fields by ranking in the top one per cent by citations for field and publication year.

Strategic Research Plan

The University maintains its commitment to agricultural and associated sciences through its Strategic Research Plan (SRP). Seven of the eight research signature areas identified in the plan directly support OMAFRA priorities. These areas differentiate UofG's research focus relative to other institutions and include food, agriculture and the bioeconomy, veterinary medicine, One Health, environmental stewardship and

[11] "UofG Retains Second Spot in Top Canadian Research University Rankings," University of Guelph News, University of Guelph, last modified January 25, 2022, https://news.uoguelph.ca/2022/01/u-of-g-retains-second-spot-in-top-canadian-research-university-rankings/

[12] "CWTS Leiden Ranking 2022," CWTS Leiden Ranking, accessed July 21, 2022, https://www.leidenranking.com/ranking/2022/list

[13] "UofG Places 16th in Global Impact in International Ranking," University of Guelph News, University of Guelph, last modified April 28, 2022, https://news.uoguelph.ca/2022/04/u-of-g-places-16th-in-global-impact-in-international-ranking/

[14] "We make quality research easy to discover," Research.com, accessed July 21, 2022, https://research.com/

[15] "OVC Professor Named to 2021 'Highly Cited Researchers' List," University of Guelph News, University of Guelph, last modified November 16, 2021, https://news.uoguelph.ca/2021/11/ovc-professor-named-to-2021-highly-cited-researchers-list/

biodiversity, community-engaged scholarship, and data science and informatics. The University is in the process of updating its SRP, which is expected to be available publicly in 2022/23.

The SRP has been partially operationalized through the recent establishment of three research institutes at the University, each of which will enhance the delivery of new knowledge which addresses the Ministry's research priorities.

Centre for Advancing Responsible and Ethical Artificial Intelligence

The Centre for Advancing Responsible and Ethical Artificial Intelligence (CARE-AI) fosters partnerships among UofG researchers and experts in private and public organizations, all looking to address real-world issues and challenges of implementing artificial intelligence (AI) using a range of applications. With a focus on humanistic aspects of AI, it is an excellent example of how UofG looks to *Improve Life*. This Centre is unique as it integrates ethics, governance, and social responsibility with technical leadership. It involves over 90 researchers and scholars from across the University who work collaboratively with inter-disciplinary departments, industry partners, as well as other institutions to support CARE-AI's ecosystem. The Centre focuses on applying machine learning and AI to UofG strengths, including human and animal health, environmental sciences, agriculture, agri-food, and the bioeconomy.

CARE-AI's advisory board includes Heather Evans, Supply Chain Manager, CDL Rapid Screening Consortium; Anthony de Fazekas, Partner and Head of Technology and Innovation – Canada, Norton Rose Fullbright; Saadia Muzaffar, CEO/Founder, TechGirls; Lara O'Donnell, Executive Director, Weston Family Foundation; Ofer Shai, Principal Software Engineer, Untether AI; and Steve Woods, CTO and Partner, Inovia Capital. The board counsels on strategy and direction for CARE-AI to ensure alignment with industry needs.

CARE-AI (in collaboration with the One Health Institute) created a SEED Fund to enhance the competitiveness of new external operating grant applications submitted by UofG faculty members and to promote student learning across multiple research disciplines. In 2021/22, CARE-AI SEED Fund announced a call for proposals for AI Inspire Grants and AI Innovation Grants. AI Inspire Grants support workshops, events, hackathons, or seminars that bring together thought leaders. CARE-AI supports the Inspire Grant recipients further by advertising the events to raise visibility and awareness among the CARE-AI community. AI Innovation Grants support interdisciplinary research collaborations for new research initiatives such as prototype development. CARE-AI also hosted several virtual seminar events in 2021/22.

One Health Institute

The One Health Institute (OHI) "…enhances and promotes academic, research and outreach programs to propel the University of Guelph to the forefront of One Health scholarship internationally."[16] It advances an interdisciplinary approach to promoting health and curbing infectious diseases. One Health tackles problems at the intersection of people, animals, and the environment. Looking at how those three components interact is key to stemming many emerging vector-borne ailments such as Lyme disease or combatting the growing health threat posed by drug-resistant microbes. This occurs through professionals working together, bringing their perspectives on animals, humans, and environmental sciences.

[16] "One Health Institute Mission," One Health Institute, University of Guelph, accessed July 21, 2022, https://onehealth.uoguelph.ca/ohi/about-ohi/

OHI's leadership includes Charlotte Yates, President of UofG; Malcolm Campbell, Vice-President (Research); and Cate Dewey, Associate Vice-President (Academic), Director of One Health. Their Advisory Group includes nine faculty members and two students.

OHI has been extremely active over the past year, generating bi-monthly newsletters and Faculty Focus Articles, delivering their seminar series, supporting student research assistantships, and reporting on the COVID-19 research being conducted by One Health affiliates at UofG who received a Catalyst grant. Catalyst Grants were offered in 2020 to provide support for small-scale, time-sensitive research projects focused on contributing to the global response to the COVID-19 pandemic.[17]

OHI continues to offer a Collaborative Specialization in One Health for Doctoral and Masters students, Doctor of Veterinary Medicine / Master of Public Health Combined Degree Program and is preparing for the first cohort of the One Health undergraduate program – the first of its kind in Canada. The first cohort will begin their studies in September 2022. This undergraduate degree program is designed to focus on giving students the skills and confidence to create multidisciplinary teams, analyze systems, and to solve complex health challenges such as infectious diseases, food insecurity, climate change and biodiversity loss. This undergraduate degree in One Health will provide students with knowledge, skills and abilities that are highly valued and essential to solving today's complex health issues – as well as the necessary background to pursue graduate work or enter into professional schools such as animal or human medicine.

Guelph Institute for Environmental Research

The Guelph Institute for Environmental Research (GIER) supports interdisciplinary research and fosters a sense of community among UofG researchers to raise the profile of environmental research at Guelph. GIER brings together researchers from all seven colleges and represents UofG's commitment to environmental research.

GIER leadership is comprised of a Director, Dr. Madhur Anand, and a Governance Committee consisting of ten members, two of which are external to the University.

In April 2022, GIER announced their partnership with rare Charitable Research Reserve, a community based urban land trust and environmental institute that protects highly sensitive lands.

In 2019/20, GIER introduced a Small Grants Program. It continues to be a success, funding six UofG interdisciplinary research projects (totaling $90,000) in 2021/22 that tackle human-environmental crises to further environmental research. This funding supports key areas of research including many that are critical to agri-food and environmental sustainability.

Third-Party Leverage

The UofG works hard to leverage the OMAFRA-UofG Agreement to grow agri-food research and innovation in Ontario. The Arrell Food Institute and Food from Thought both continue to contribute to the $61.9M in non-Agreement funding awarded to the UofG for research projects that are supportive of OMAFRA priorities. Together, these investments enhance Guelph's position as a nexus of agri-food innovation, where academia,

[17] "University of Guelph - COVID-19 Research Development & Catalyst Fund," Research Alerts, University of Guelph, accessed July 21, 2022, https://www.uoguelph.ca/research/alerts/content/university-guelph-covid-19-research-development-catalyst-fund

government and industry come together to support the provincial, national, and international agri-food sectors, and rural communities.

The University has also been working to identify third-party incremental leverage for the research programs and in support of infrastructure projects. This is being accomplished through allocation of some of the University's Canada Foundation for Innovation (CFI) envelopes to purchase equipment for the Guelph and Ridgetown Campuses, as well as the ARIO Research Centres. This enhances UofG's research capacity in support of Ministry priorities. These awards to researchers are adjudicated based on excellence of the researcher, novelty and leading-edge nature of the proposed research, and the benefit to civil society. Thus, these sources of funding are complementary to the ARIO Minor Capital Program and Research Centre operational funding received from OMAFRA.

Over the past two years, the UofG has been successful with a new source of federal funding to leverage OMAFRA support, namely the Natural Sciences and Engineering Research Council's (NSERC) Alliance program, which has replaced the former NSERC Collaborative Research and Development Grants (CRD) and Strategic Networks/Grants programs. The crucial difference between the two programs is that federal and provincial funding can now be included in the leverage calculations. UofG researchers have returned more than six times the value of OMAFRA investment in their Alliance research projects by leveraging OMAFRA funding to attract new federal awards and private- and public-sector financial support. This new opportunity for leverage has resulted in the University of Guelph leading Canadian universities in absolute dollar value of NSERC Alliance awards for this past fiscal year. Between 2020 and 2022, 12 UofG researchers leveraged OMAFRA investment to attract more than $4M in new funding from the NSERC Alliance grants program, expanding their research projects and generating new knowledge and innovations that benefit the agri-food sector in Ontario and across Canada.

In addition, researchers from the University have received numerous research grants and gifts in areas relevant to the Ministry's priorities, further leveraging Ontario's investment. Some examples of these are:

- More than $6M in NSERC Discovery funding. Forty-three UofG researchers will receive more than $6M over five years from the federal agency. The funding spans six colleges and dozens of departments.
- Between 2020 and 2022, 12 UofG researchers leveraged OMAFRA investment to attract more than $4M in new funding from the NSERC Alliance grants program, expanding their research projects and generating new knowledge and innovations that benefit the agri-food sector in Ontario and across Canada.
- Three University of Guelph researchers in areas of interest to the Ministry received $1.6M in funding from the Canada Research Chair (CRC) program. New chairs were awarded to Dr. Clara Cho (Tier 2 CRC), Department of Human Health and Nutritional Sciences; and Jesse Popp (Tier 2 CRC), School of Environmental Sciences. A Tier 2 CRC held by Dr. Michael Rogers, Department of Food Science, was renewed for a second term. Drs. Cho and Popp will also receive infrastructure funding through the John R. Evans Leaders Fund, developed by the CFI in collaboration with the CRC program.
- $24M in funding for the UofG-led BIOSCAN project through the Tri-Council's New Frontiers in Research Fund (supported by NSERC, SSHRC, and CIHR). The BIOSCAN-Canada project will inventory the country's organisms and probe their interactions to catalogue and, ultimately, preserve Canadian biodiversity. Led by Dr. Paul Hebert, a professor in the College of Biological Science and director of UofG's Centre for Biodiversity Genomics, this global biodiversity project was among seven initiatives nationwide to receive awards under the Transformation 2020 competition run by the Canada Research Coordinating Committee.
- An additional $7.2M in funding for BIOSCAN-Canada project through Genome Canada's Large-Scale Applied Research Project (LSARP) competition.

Indigenization, Equity, Diversity, and Inclusion

As part of the renewal process, the Ontario Agri-Food Innovation Alliance formed an Equity, Diversity, and Inclusion (EDI) Advisory Group. Its mandate includes developing an EDI Statement and Action Plan. EDI policies and principles related to the Research Program will stem from those activities.

The UofG continues to advance consideration of EDI in its daily practices, as well as its future planning. Office of Research Agri-Food Partnership staff took part in a training session offered by the Office of Diversity and Human Rights called "Opposing Oppression: Applying Equity and Inclusion Lenses to Research". In addition, the Office of Research Agri-Food Partnership and the Office of Research Services jointly hired an Indigenization, Equity, Diversity, and Inclusion (IEDI) Advisor in Research. Ms. Joanne Garcia-Moores started the role in April 2022 and will have a significant impact on supporting the implementation of IEDI principles in the Research Program.

Safeguarding Research

The Vice-President (Research) gave a presentation to OMAFRA in April 2022 on safeguarding research to build knowledge and understanding of this important emerging issue. A review of recently funded Alliance projects was undertaken to assess risks related to project partners and team members; no risks were identified.

Alliance staff are evaluating how program documentation and administrative processes can be enhanced to increase awareness and ensure alignment with safeguarding research considerations. In general, researchers are directed to relevant UofG resources on the Office of Research Safeguarding Research webpage for additional information and training.

COVID-19

Research productivity was impacted to varying degrees in 2021/22. Overall, the COVID-19 pandemic continued to lead to delays/slowdowns in research activity and productivity due to researcher fatigue, limitations in access to facilities/equipment, restrictions on face-to-face interactions, and/or challenges experienced by graduate students and staff. Many research technicians have been able to continue their work, as the Ontario Agri-Food Research Centres and laboratories have been operational, though some were still operating at reduced levels to accommodate physical distancing well into 2021/22. Slower research activity and limitations on physical gatherings have translated into fewer research outputs and less collaboration and knowledge translation in the short-term. In 2021/22, the Alliance continued to adapt its operations to support researchers as effectively as possible.

Research productivity is expected to return to near normal levels in 2022/23, depending on any resurgences of the virus. At this point in time, the requirement for Research Management Plans have been paused, as have many of the public health measures that were limiting capacity and in-person interactions.

In 2021/22, the University was able to achieve most of its metrics, despite the COVID-19 pandemic. In general, the impact of COVID-19 on the Research Program has been diffuse and is expected to continue in some form into the near future.

Alliance Programming

Throughout 2021/22, the UofG continued to improve processes and policies to operate the highest quality Research Program effectively and efficiently. Specifically, the following policies were completed and approved: the Lead Applicant and Co-Applicant Policy; the Issues Resolution Policy; and the Report Review Policy. The Alliance website was updated with a Ontario Agri-Food Innovation Alliance: Resources for Researchers webpage to support researchers in their proposal development and reporting. Researchers were also offered a proposal development workshop and virtual office hours, as other mechanisms of support.

The continued development of the Research Management System (RMS), the database used to administer all Research Projects, was a continued focus for 2021/22. Substantial amounts of time were invested in system improvements, and remediation. The University continues to experience ongoing issues with RMS. On a regular basis, aspects of the system cease to function or disappear entirely. RMS is hampering the University's ability to support the Research Program effectively and efficiently, as well as report on its outcomes.

The Office of Research Agri-Food Partnership staff have been working collaboratively with UofG researchers to discuss ways of enhancing the research platforms to take advantage of new opportunities and/or areas of research. For example, significant improvements at Elora and New Liskeard have enhanced research opportunities in pasture and forage management and precision feed production, namely the recently completed infrastructure upgrades at the Ontario Beef Research Centre (OBRC) - Elora and OBRC – New Liskeard. In addition, the University continues to work on enhancing the capture, storage, sharing and re-use of data generated at Ontario's Agri-Food Research Centres.

Significant improvements were made to the HQP Scholarship review process in 2021/22 following a number of consultations. A new two-stage process involving 'block reviews' was developed and implemented, which ensured that each scholarship application was thoroughly discussed by a group of reviewers. These changes improved the process, were well received by reviewers, and, ultimately, ensured that the best qualified recipients received the scholarships.

During 2021/22, the Research Innovation Office (RIO) released an online Intellectual Property (IP) Education module for use by the campus community and created and published its first 'Commercialization Framework', which outlines the institution's campus-wide commitments to help to commercialize IP arising from its research programs. The IP Education Program has seen 90 enrolments to-date and has been well-received by those completing it. The Industry Liaison team also helped to successfully attract additional funding for research in the agri-food sector, with 41 projects closed last year.

The Agreement requires that the UofG complete a Research Impact Case Study, a qualitative assessment to illustrate the longer-term cumulative impact of research and KTT activities on the end-user audience, which resulted in the creation of three 100+ page impact case studies. In 2021/22, the UofG transformed the communications summaries of these impact case studies into engaging online assets to increase awareness of research findings and how funding through the Alliance research program delivers *Ontario Solutions with Global Impact*. The series is available digitally via a Microsoft Sway webpage dedicated to each case study theme, Research Impact Case Study: Dairy, Research Impact Case Study: Breeding & Genetics, and Research Impact Case Study: Innovation, as well as via fully accessibly PDFs on the Ontario Agri-Food Innovation Alliance: Case Studies webpage. Since their launch, these assets have made a significant impression on external parties.

Finally, the successes of the Research Program are clearly demonstrated in Tables 3.1 to 3.3, which provide a summary of key performance metrics. More details about the achievements and outcomes of the Research Program follow.

Table 3.1: Key Performance Metrics for the Research Program – Intellectual Capacity

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Faculty FTEs in Research Projects	77.7	75.5	76.6	**78.3**		67.8
Number of Faculty Involved in Agreement-funded Research	246	263	257	**247**		N/A
Research Technician FTEs	87.6	96.7	108.1	**104.0**		42.4
Number of Technicians Involved in Agreement-funded Research	164	183	192	**185**		N/A
Research Support FTEs	22.8	22.5	22.8	**22.6**		22.5
Faculty FTEs Engaged in Research Supportive of Ministry Priorities	153.0	152.1	149.6	**148.6**		97.0
Number of Faculty Involved in Research Supportive of Ministry Priorities	364	385	393	**395**		N/A
Number of HQP per $1M Invested	17.1	17.0	17.1	**17.2**		14.0
HQP Employment in the Agri-Food or Rural Sectors	N/A	76% (HQP)	96% (USEL)	**N/A**		75%

Table 3.2: Key Performance Metrics for the Research Program – Leverage and Partnerships

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Ratio of Third- Party Funding and In-Kind Contributions in Research Projects	1.00:1	0.93:1	1.02:1	**0.93:1**		1.00:1
Value of Third- Party Funding and In-Kind Contributions in Research Projects	$6.32M	$6.15M	$7.89M	**$7.12M**		N/A
Ratio of Third-Party Funding for Research Supportive of Ministry Priorities to Agreement Investment	1.05:1	1.03:1	1.07:1	**1.20:1**		0.70:1
Value of Third-Party Funding for Research Supportive of Ministry Priorities	$53.4M	$53.1M	$55.3M	**$61.9M**		N/A
Number of Co-Funders per $1M Invested	19.2	22.3	19.6	**19.3**		20.0
Number of Collaborators per $1M Invested	41.5	38.8	31.7	**34.2**		35
Third-Party Funding Directed at Tier II and III Research Projects	$7.62M	$2.79M	$11.57M	**$6.72M**		N/A

Table 3.3: Key Performance Metrics for the Research Program – Commercialization

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Number of Patents Filed	10	20	20	**26**		17
Number of Patents Issued	4	12	3	**4**		5
Number of Licenses	22	20	35	**25**		19
License Revenue Generated	$1.67M	$1.56M	$1.73M	**$1.58M**		$1.50M
Number of Intellectual Property Disclosures	183	154	171	**54**		N/A

3.1.1 Research Faculty

Ontario needs a critical mass of world-class researchers to ensure the agri-food sector is poised to address current challenges and meet future opportunities. The University leverages investments made through the Agreement to ensure Ontario has the intellectual capacity to support a sustainable, globally competitive agri-food sector, and vibrant rural communities.

In 2021/22, the UofG attracted external investments and recruited research leaders to faculty positions, enhancing capacity to meet Ministry priorities and position Ontario as a global leader in agri-food innovation. Over the last year, 18 new faculty members began in agri-food or agri-food-related positions at the University. This was an increase from the 12 faculty members hired in agri-food-related positions in 2020/21.

- Two named positions, made possible through external support
    - Dr. Barak Aharonson – John F. Wood Chair in Innovation Management
    - Dr. Anna Kate Shoveller - Champion Petfoods Chair in Canine and Feline Nutrition, Physiology and Metabolism (existing faculty member)
- Additional positions, either new capacity or replacement capacity for resignations/retirements
    - Dr. Sarah Alderman – Stress Physiology and Environmental Toxicology
    - Dr. Emma Borkowski – Anatomic Pathology
    - Dr. Susan Chiblow – Plant and Environmental Health
    - Dr. Clara Cho – Precision Nutrition
    - Dr. Sherri Cox – Wildlife Rehabilitation and Conservation
    - Dr. Marcio Duarte – Meat Science and Muscle Biology
    - Dr. Marie Soleil Dubois – Large Animal Surgery
    - Dr. Basem Gohar – Qualitative Research Methods and Knowledge Synthesis
    - Dr. Lauren Grant – Public Health
    - Dr. Ahmed Refaey Hussein – Cyber-Physical Computing Systems
    - Dr. Audrey Jamal – Local Economic Development
    - Dr. Diana Lewis – One Health
    - Dr. Alice Marciniak – Dairy Science
    - Dr. Samantha Payne – Veterinary Anatomy
    - Dr. Kelsey Spence – Epidemiology and One Health
    - Dr. Laura Van Patter – Community Medicine (Veterinary)
    - Dr. Yang Xu – Plant Lipid Biosynthesis

There were a number of Canada Research Chair (CRC) appointments, new and renewed, in areas of interest to the Ministry.

Dr. Jesse Popp is a newly appointed Tier 2 CRC in Indigenous Environmental Science. Her scholarship weaves together Indigenous and Western ways of knowing to advance environmental and ecological science, ranging

from climate change impacts to biodiversity conservation. Her lab supports research partnerships among Indigenous communities, conservation groups, governments, and other universities.

Dr. Clara Cho is a newly appointed Tier 2 CRC in Precision Nutrition. She studies mechanisms underlying metabolic disorders, notably micronutrients such as folate, choline and betaine involved in complex metabolic pathways. Her research explores the relationship between diet and disease risk, which is complicated by individual differences in genetics, microbiome (gut microbes), physiology, lifestyle, and other factors.

Dr. Michael Rogers' Tier 2 CRC in Food Nanotechnology was renewed to 2026. He studies new food technologies to curb diet-related chronic illnesses. Equipped with a robotic simulated gastrointestinal tract – the TIM-1, one of only three at Canadian universities – his lab studies nanotechnology to replace saturated and trans fats with healthier unsaturated oils while maintaining desired physical properties of the original foods. Rogers looks at impacts of food processing on chemistry and bioavailability of food materials, including digestion and absorption of nutrients from manufactured and processed foods.

There were a number of other faculty members honoured in 2021/22, including:

- **Dr. Christine Baes** received one of the 2021 Minister's Awards of Excellence from the Ontario Ministry of Colleges and Universities (MCU) in the category of innovation and entrepreneurship. Baes' research focuses on improving the health, welfare, and productivity of farm animals through genetic and genomic selection.
- **Dr. David Kelton** was inducted as a Fellow of the Canadian Academy of Health Sciences (CAHS). Dr. Kelton's research focuses on maintaining a healthy and sustainable food supply using a One Health approach for the prevention of infectious diseases.
- **Dr. Alan Ker** was named as a Fellow of the Canadian Agricultural Economics Society for demonstrating distinguished contributions to the advancement of the Canadian agricultural and resource economics profession and building its institutions.
- **Dr. Bonnie Mallard** won the prestigious NSERC Synergy Award for Innovation for outstanding and exemplary collaborations between industry and post-secondary institutions. Dr. Mallard received the $200,000 national award for her leading research in genetic regulation of the immune system. She aims to develop preventive methods to improve disease resistance of livestock.
- **Dr. Amar Mohanty**, director of UofG's Bioproducts Discovery and Development Centre (BDDC) and an internationally recognized leader in bioplastics and biocomposites used in everything from car parts to consumer goods, was the 2021 recipient of the prestigious Miroslaw Romanowski Medal presented by the Royal Society of Canada. The annual award recognizes significant scientific contributions toward solving environmental problems or improving ecosystem quality.
- **Dr. Jesse Popp** was named to the Indigenous Leadership Circle in Research, a group formed by the Canadian Research Coordinating Committee to advise the country's three federal research funding agencies. Dr. Popp will join a group of more than 20 academics, Indigenous Elders, and community members to monitor the progress of a strategic plan developed to ensure new models for Indigenous research and research training are informed by First Nations, Inuit and Métis Peoples.

Table 3.4 provides the status of each of the activities related to Research Faculty identified in the 2021/22 Business Plan, as well as provides an update on any incomplete items from the 2020/21 Business Plan.

Table 3.4: Status Update on Business Plan Activities – Research Faculty

Business Plan Activity	Status
Introducing new Faculty Members to the Agreement and the opportunities it provides	Ongoing. A 'New Faculty Orientation' day is held each Fall where the Associate Vice-President Research (Agri-Food Partnership) presents information to new faculty members about the Alliance and

Business Plan Activity	Status
	encourages them to get involved. In addition, Office of Research Agri-Food Partnership staff presented at a session on research application processes and the resources available held specifically for newer OAC faculty.
Linking Faculty Members from different disciplines and encouraging them to consider forming interdisciplinary teams to address OMAFRA priorities	Ongoing. The Office of Research Agri-Food Partnership attempts to connect faculty members from different disciplines, through a variety of channels, as needed. This is especially important for the Special Initiatives program.
Mapping Faculty Members' expertise to the new OMAFRA priority areas, noting areas of untapped capacity and areas where additional capacity may be required	Ongoing. The University continues to identify how the expertise of faculty members, especially new hires, relates to OMAFRA's priority areas. For the 2021/22 call cycle, the University attempted to highlight some of the underrepresented research priorities by reaching out to UofG faculty with the disciplinary expertise to address those research needs. A meeting with Department of Food, Agricultural and Resource Economics (FARE) and Lang School of Business was held to promote the Tier I Call and discuss relevant research questions. 17 faculty members attended the session. Ultimately, eight proposals were received from FARE/Lang faculty members and three were successful, with success rate increasing from 11% in 2020/21 to 38% in 2021/22. In addition, the University also did some targeted outreach to the College of Engineering and Physical Sciences (CEPS). Relevant research priorities were sent to CEPS College Research Manager for distribution to their faculty. In future years, a meeting to further engage CEPS faculty will be undertaken.
Meeting regularly with the Deans to discuss their hiring plans, noting impacts on the Agreement	Ongoing. The Office of Research Agri-Food Partnership meets frequently with the Deans of the Ontario Agricultural College and the Ontario Veterinary College to discuss hiring plans and their impact on the Agreement.
Acting as an enabler between Faculty Members and OMAFRA staff, helping them make connections and establish quality collaborations	Ongoing. The Office of Research Agri-Food Partnership assists faculty members in making connections with OMAFRA staff, either through the Research and Innovation Branch (RIB) or directly with the program areas. This is especially important for new faculty members, as well as for faculty members who are new to the Alliance. In 2021/22, the Alliance helped to organize Discovery and Dialogue Meetings, which were an opportunity for faculty to learn more about OMAFRA research priories by interacting with OMAFRA specialists. In addition, Alliance staff facilitated a meeting between the University and OMAFRA on the One Health agenda.

Business Plan Activity	Status
Engaging with OMAFRA Leaders to discuss emerging areas that may require new capacity	Ongoing. However, this activity has been limited due to COVID-19. To increase interaction between the University and OMAFRA, a virtual Meet and Greet between the Research Program Directors (RPDs) and the OMAFRA Research Directors took place November 20, 2021. In general, more engagement would be beneficial to all parties.
Continuing to work with the Deans to advance the University of Guelph's primacy as "Canada's Food University" through strategic hiring to maintain capacity and through the pursuit of major gifts/grants in support of the agri-food continuum	In progress. The Office of Research Agri-Food Partnership has strong working relationships with each of the seven Colleges, which are leveraged to support capacity planning. In addition, the Associate Vice-President Research (Agri-Food Partnership) works closely with the Deans to continue to advance the University of Guelph's primacy as Canada's Food University through strategic hiring and the pursuit of major gifts/grants in support of the agri-food continuum.

3.1.2 Research Support

Research Support provides the critical mass of technicians and other support personnel to provide knowledge and expertise which optimize the use of intellectual capacity and research infrastructure to achieve Agreement outcomes. This provides benefits to all of Ontario's regions and increases access to and sharing of data to facilitate new agri-food and rural research and data analytics to inform decision-making. Research Support, as a program activity, remains relatively stable year to year.

Table 3.5 provides a list of all the Tiers II, III and IV projects approved as part of the Agreement in 2021/22. In the past, these projects were not listed in the Consolidated Annual Report, as they do not receive direct operating funding. However, it is important to recognize OMAFRA's support of the Tier II and III projects, in the form of technical support as well as subsidized access to the Research Centres. Without that support, these projects would not be possible. The Tier IV projects have been included for completeness, as they occur at the Research Centres. Tier IV projects are performed on a full-cost recovery basis.

Table 3.5: 2021/22 Tiers II, III and IV Research Projects

Lead Applicant	Project Title	Research Priority	Type
John Barta	In-animal production of coccidia (Eimeria species) of commercial poultry for basic and applied research uses	Animal Health & Welfare	Tier II
Marcio Duarte	Effects of maternal supplementation of vitamin A during late gestation on intramuscular fat deposition in the offspring	Competitive Production Systems	Tier II
Mark Hurtig	Predicting osteochondral graft allograft integration after long term room temperature storage in sheep	Innovative Products & Product Improvement	Tier II
Melanie Kalischuk	Advanced management techniques for specialty crops in Ontario	Plant Health & Protection	Tier II
Niel Karrow	Impact of maternal diet on small ruminant colostrum bioactives and postnatal health	Animal Health & Welfare	Tier II
Niel Karrow	Effect and mitigation of Fusarium mycotoxin exposure to late gestation sows	Animal Health & Welfare	Tier II

Lead Applicant	Project Title	Research Priority	Type
Elijah Kiarie	Investigations on the impact of maternal and perinatal nutritional strategies on growth performance and immunocompetence in piglets and broiler chicks	Animal Health & Welfare	Tier II
Elijah Kiarie	Nutritional approaches to enhance pullet development, egg production and quality	Animal Health & Welfare	Tier II
Thomas Gadegaard Koch	Assessment of safety of encapsulated MSC and pooled MSC in the fetlock joints of horses	Animal Health & Welfare	Tier II
Thomas Gadegaard Koch	Assessment of safety of antisense miRNA-181 to treat fetlock OA	Animal Health & Welfare	Tier II
Thomas Gadegaard Koch	Fetlock chip model MSC OA treatment	Animal Health & Welfare	Tier II
Stephen LeBlanc	Interactions between systemic and uterine inflammation in dairy cows	Animal Health & Welfare	Tier II
Steven Loewen	Processing tomato breeding 2021 to 2023	Sustainable Production Systems	Tier II
Eric Lyons	Improving functional horticulture through innovation, product testing, and cultivar evaluation	Competitive Production Systems	Tier II
Bonnie Mallard	Genetic and environmental influences on disease survivability and colostrum quality in dairy cows and their calves	Animal Health & Welfare	Tier II
Bonnie Mallard	Evaluating High Immune Response Technology™ in beef cattle for climate change, calf health and development of a genomics test for immune response	Animal Health & Welfare	Tier II
Wendy Pearson	Fatness, fitness and affliction: Are there inflammatory consequences to exercise when you're a fat horse?	Animal Health & Welfare	Tier II
Istvan Rajcan	Breeding of high yielding, disease resistant & value-added soybean using elite and exotic germplasm	Innovative Products & Product Improvement	Tier II
David Renaud	Evaluation of an automated feeder algorithm as an intervention to ameliorate diarrhea and improve performance in calves using a Non-Steroidal Anti-inflammatory Drug (NSAID)	Animal Health & Welfare	Tier II
Darren Robinson	Weed management in processing vegetables	Plant Health & Protection	Tier II
Shayan Sharif	Studies of host-pathogen interaction in chickens	Animal Health & Welfare	Tier II
Peter Sikkema	Crop tolerance and weed control efficacy evaluations with registered and experimental herbicides in corn, soybean, dry beans and cereals	Plant Health & Protection	Tier II
François Tardif	Evaluation of new herbicide active ingredients for integrated weed management in field crops	Plant Health & Protection	Tier II

Lead Applicant	Project Title	Research Priority	Type
Cheryl Trueman	Pest management in field vegetables and sugarbeets	Plant Health & Protection	Tier II
Katie Wood	Improving feed efficiency in the cow herd: Individual cow variability in fibre digestibility, feed efficiency, and methane emissions.	Sustainable Production Systems	Tier II
Katie Wood	Understanding the impact of yeast on gut health, digestibility and rumen pH	Sustainable Production Systems	Tier II
Sarah Wootton	Development of a viral vectored vaccine for mucosal immunization against emerging pathogens	Animal Health & Welfare	Tier II
John Barta	Efficacy testing of a live coccidiosis vaccine	Animal Health & Welfare	Tier IV
Marcia Chiasson	Comparative growth and slaughter traits of diploid and triploid rainbow trout from three cultured strains	Animal Health & Welfare	Tier IV
Marcia Chiasson	Assessment of over-ripened oocytes in salmonids to determine markers for egg quality	Animal Health & Welfare	Tier IV
Marcia Chiasson	Reproduction of lake whitefish for commercial aquaculture	Sustainable Production Systems	Tier IV
Marcia Chiasson	Safety testing of autogenous immersion vaccine for rainbow trout	Animal Health & Welfare	Tier IV
Jocelyn Smith	Bayer 2021 field trials	Plant Health & Protection	Tier IV

Table 3.6 demonstrates the number of awarded Tier II, III and IV projects (as recorded in RMS), over the term of the Agreement.

Table 3.6: Number of Tier II, III and IV Projects Supported over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23
Tier II	13	18	30	**27**	
Tier III	1	0	0	**0**	
Tier IV	0	1	5	**6**	

Research Program Directors (RPDs) play a vital leadership role in the delivery of the research program and the achievement of KPIs. Specifically, RPDs help to ensure that Agreement-funded research meets the priorities set by OMAFRA, that research results are disseminated, and that partnerships are built with stakeholders. As leaders in their field of research, RPDs also act as ambassadors for the Ontario Agri-Food Innovation Alliance, both locally and globally. Promoting Alliance priorities to UofG researchers, while encouraging and fostering collaboration with leading researchers from around the world, helps ensure that the University can develop and maintain the capacity to respond to emerging agri-food related research problems and opportunities.

The terms of all the RPDs expired in 2021/22. Prior to moving forward, the University completed a review of the RPD role and responsibilities, in conjunction with an examination of the existing RPDs' disciplinary strengths and the needs of the Research Program. The RPDs were also asked to identify if they wished to continue in the role. All RPDs, but one, Dr. Stephen LeBlanc, indicated a desire to continue. The RPDs were reappointed, and two searches were held to cover the vacant RPD position and a temporary leave. Table 3.7 provides an up to date list of the RPDs and their new terms.

Table 3.7: Research Program Directors

Research Priority Area	Name	Department	Term
Animal Health and Welfare; Competitive Production Systems	Dr. Trevor DeVries	Department of Animal Biosciences	September 1, 2021 to August 31, 2024
Plant Health and Protection; Competitive Production Systems	Dr. Mary Ruth McDonald	Department of Plant Agriculture	July 1, 2021 to June 30, 2024
Innovative Products and Product Improvement; Trade, Market, Targeted Sector Growth; Competitive Production Systems (Bioeconomy)	Dr. Manjusri Misra	School of Engineering	September 1, 2021 to August 31, 2024
Animal Health and Welfare; Food Safety	Dr. Zvonimir Poljak	Department of Population Medicine	September 1, 2021 to August 31, 2024
Innovative Products and Product Improvement	Dr. Paul Spagnuolo	Department of Food Science	July 1, 2021 to June 30, 2024
Soil Health; Water Quality and Quantity; Sustainable Production Systems	Dr. Laura Van Eerd	School of Environmental Sciences, Ridgetown	July 1, 2021 to June 30, 2024
Productive Land Capacity; Trade, Market, Targeted Sector Growth; Strong Rural Communities	Dr. Alfons Weersink[18]	Department of Food, Agricultural and Resource Economics	September 1, 2021 to August 31, 2022
Data Strategy	Dr. Rozita Dara	School of Computer Science	September 1, 2021 to August 31, 2024
Knowledge Translation and Transfer Program	Dr. Alison Duncan	Department of Human Health and Nutritional Sciences	July 1, 2021 to June 30, 2024
Highly Qualified Personnel (HQP) Scholarship Program	Dr. Keith Warriner	Department of Food Science	July 1, 2021 to June 30, 2024

Table 3.8 provides the status of each of the activities related to Research Support identified in the 2021/22 Business Plan, as well as provides an update on any incomplete items from the 2020/21 Business Plan.

Table 3.8: Status Update on Business Plan Activities – Research Support

Business Plan Activity	Status
Ensuring appropriate levels of technical capacity exist to effectively use the Ontario Agri-Food Research Centres	In progress. A thorough review of the technical capacity within the Agreement was done in 2021/22. The University will be looking at how and where technical capacity is assigned, as part of the renewal process.
Continuing to work with academic units to identify and address changes that would impact Agreement staffing levels	Ongoing. The Office of Research Agri-Food Partnership works directly with Departments to identify and address upcoming retirements or staffing changes which would impact the Agreement.

[18] Dr. Weersink is covering Dr. Kate Parizeau's temporary leave.

Business Plan Activity	Status
In conjunction with the Property Management Program, enhancing the research platforms to cultivate new opportunities	Ongoing. The Office of Research Agri-Food Partnership staff work collaboratively with UofG researchers to discuss ways of enhancing the research platforms to take advantage of new opportunities and/or areas of research. For example, significant work has been done at Elora and New Liskeard to enhance research opportunities in pasture and forage management and precision feed production, in light of the recently completed infrastructure upgrades at OBRC - Elora and OBRC – New Liskeard. In addition, the University continues to work on enhancing the capture, storage, sharing and re-use of data generated at Ontario's Agri-Food Research Centres.
Improving the methods of recording Research Technician involvement in Tiers II, III and IV Projects, using RMS	Complete. Research Technicians can be effectively recorded in RMS on Tier II, III and IV projects as members of the Team. Researchers who do not utilize the Research Centres but have access to technical capacity have been asked to record this support in Tier II projects. Guidelines on recording Research Technicians have been included in the program guides.
Creating program guides for the Tiers II, III and IV programs	In progress. Draft program guides have been created for Tiers II and III. Their completion will be finalized after the approval of the Tiers II and III policies. A program guide for Tier IV is underway and will be completed in 2022/23.
Continuing to develop the policies and processes for Tiers II, III and IV, including approval processes and reporting requirements, with the goals of improving accountability and reporting	In progress. Policies and processes are in development for each of Tiers II, III and IV. The University has also created a summary guide to clarify the differences among the tiers. This will be shared with OMAFRA in 2022/23. The Tiers II and III policy has been drafted and will be shared with OMAFRA shortly. The Tier IV policy was discussed with OMAFRA in 2021/22. Some adjustments need to be made, but it is expected that the policy will be finalized and approved in 2022/23.
Reviewing other aspects of the Research Support program activity, including the Superior Plant Upgrading and Distribution (SPUD) Unit at the New Liskeard Agricultural Research Station (NLARS)	In progress. A thorough review of all aspects of the Research Support program activity was completed in 2021/22 and discussed with the University's Research Program Consultation table. The University is aware of a business case prepared for the Ontario Berry Growers Association regarding the future of clean plant propagation in Ontario. The University will work with OMAFRA to consider options for the SPUD Unit going forward.
Updating the allocations of support staff relative to research faculty FTE engaged in research projects	On hold. The methodology for support staff allocations relative to research faculty FTE engaged in Research Projects has been reviewed. Revisions to support staff allocations will be

Business Plan Activity	Status
	implemented for 2022/23, dependent on the outcomes of renewal discussions.
Expanding the student ambassador program, which engages UofG graduate students working in agri-food to deliver tours of the research facilities, to include the Ontario Beef Research Centre	On hold. The Ontario Agri-Food Research Centres were closed to all non-essential personnel from March 2020 to September 2021 and only available to essential tours from September 2021 to March 2022, COVID-19 protocols permitting. Regular research centre tours resumed March 21st, 2022. The student ambassador program will resume in 2022/23, assuming the pandemic continues to wane. At that point, expansion of the program will be considered.
Refining established biosecurity protocols for the ARIO Research Centres, starting with dairy and beef, to continue providing tours while ensuring the safety of tour participants and animals	On hold. The University will revisit the biosecurity protocols in 2022/23.
Mapping technical expertise to existing and emerging OMAFRA priorities	In progress. A thorough review of the technical capacity within the Agreement was done in 2021/22. The University will be looking at how and where technical capacity is assigned, as part of the Agreement renewal process.

3.1.2.1 Long-Term Trials

Long-term trials are also a component of the Research Support program activity. A Long-Term Trials Advisory Group was formed, and contains representation from the UofG, OMAFRA (both the Research and Innovation Branch (RIB) and the Agriculture Development Branch (ADB)) and Industry (Grain Farmers of Ontario). There was minimal activity from the Advisory Group in 2021/22, however an increased level of activity is anticipated in 2022/23.

To support the long-term trials in 2021/22, researchers were reimbursed for operating costs. Prior to reimbursement, researchers were required to submit a long-term trials report outlining the key findings from their work. Ideally, in the future, these reports will be completed using RMS.

Table 3.9 provides the status of each of the activities related to Long-Term Trials identified in the 2021/22 Business Plan, as well as provides an update on any incomplete items from the 2020/21 Business Plan.

Table 3.9: Status Update on Business Plan Activities – Long-Term Trials

Business Plan Activity	Status
Supporting researchers in organizing and storing the long-term trial data	In progress. Dr. Rozita Dara and her team worked closely with a technician from the Department of Plant Agriculture to incorporate a portion of the long-term trial data into the existing Research Centre Data Access Portal. This option will be considered for the remaining long-term trial data in 2022/23. In addition, the University was invited to participate in the Diverse Rotations Increase Valuable Ecosystem Services (DRIVES) Network project. As described in an Information Note shared with R/PM PMC, the goal of the network is to establish a database of data from long-term

Business Plan Activity	Status
	crop rotation experiments across North America and connect researchers interested in cross-location, system-level analysis. The results produced by the DRIVES Network will be used to inform policy, serving as a legacy of long-term agroecosystem observations for future generations. With inclusion of the Alliance data, UofG researchers would be involved in collaborations with the network, synthesizing the broader datasets, and publishing results.
Continuing regular meetings of the Advisory Group to discuss optimal operation and management of long-term trials	On hold. The Advisory Group did not meet in 2021/22. Regular meetings, ideally twice per year, will be established for 2022/23.
Creating a policy document relating to the governance of long-term trials, specifically addressing questions of trial creation and dissolution	In progress. An outline of the policy document has been drafted based on the first meeting of the Advisory Group. Subsequent meetings in 2022/23 will be used to complete the policy document.
Continuing to refine the process of awarding long-term trial funds and recording deliverables	On hold. These processes will be discussed with the Advisory Group in 2022/23. Once they have been confirmed, a request to implement them in RMS will be issued.

3.1.3 Highly Qualified Personnel Scholarship Program

The Agreement supports the next generation of agri-food innovators by providing training opportunities for graduate students dedicated to Ontario's agri-food sector through the Highly Qualified Personnel (HQP) Scholarship Program. There were 87 applicants to the 2021/22 call, with a total ask of $3.6M. This was a reduction from the 111 applicants in 2020/21 and was more consistent with the 2019/20 count of 94. There was a notable drop in the number of international applicants, which was understandable given the COVID-19 situation.

There were 14 HQP Scholarships awarded in 2021/22, as shown in Table 3.10. Eight of these scholarships were provided to Masters students (three Entrance and five In-Course) and six to Doctoral students (two Entrance and four In-Course). Table 3.10 outlines information about the new award winners. These 14 new students add to the 11 continuing Masters and 20 continuing Doctoral students, bringing the total cohort participating in the program in 2021/22 to 45 students.

Over its existence, the HQP Scholarship Program has supported the development of more than 200 students who are the future researchers, policymakers and innovators in government, academia, the agri-food sector and rural economic development.

Under the Agreement, the University has an annual requirement to find $250K in matching funding for the HQP Scholarship Program. To meet this requirement, a partnership was developed with the Canada First Research Excellence Fund (CFREF) Food from Thought Program. Food from Thought committed the $250K in matching funds for 2021/22, as well as provided an additional $70K in scholarship support. This novel partnership provides significant benefits to both parties, including attraction and retention of the best and brightest talent for the agri-food sector and mobilization of knowledge for the benefit of both society and the economy.

Table 3.10: 2021/22 HQP Scholarship Program Award Winners

Student Name	Project Title	Faculty Advisor	Department Name	Degree, Scholarship Type
Olatunbosun Ayetan	Comparing tractor tires and tracks for their effects on compaction of agricultural soils using x-ray computed tomography	Richard Heck	School of Environmental Sciences	PhD, In-Course Scholarship
Havelah Carter	Evaluation of the efficacy of colostrum as a treatment for diarrhea in neonatal dairy calves	David Renaud	Department of Population Medicine	MSc, In-Course Scholarship
Daniel Colcuc	Effectiveness of various cover crops to access phosphorus from struvite fertilizer and the effect on subsequent crop's	Kim Schneider	Department of Plant Agriculture	MSc, Entrance Scholarship
Domenique Mastronardi	Production of protein-rich snacks using second grade/culled peaches	Ashutosh Singh	School of Engineering	MASc, In-Course Scholarship
Leonardo Melo	Low-cost and scalable water disinfection technology development for livestock farm stormwater treatment and irrigation re-use	Rafael Santos	School of Engineering	PhD, Entrance Scholarship
Ibrahim Mohammed	Assessing the influence of functional and structural complexity of organic matter on phosphorus mobility, crop production, and soil health	James Longstaffe	School of Environmental Sciences	PhD, In-Course Scholarship
Kurtis Pilkington	Physiological analysis of lodging and yield response to plant growth regulators in winter wheat	Joshua Nasielski	Department of Plant Agriculture	MSc, In-Course Scholarship
Michael Pupulin	A spatio-temporal model for the spread of fire blight in Ontario apple orchards, an investigation into profit-maximizing control strategies.	Hermann Eberl	Department of Mathematics and Statistics	MSc, In-Course Scholarship
Sarah Rixon	Impact of seasonality on nutrient transport and groundwater-surface water interactions under temperate climate conditions in an agriculturally-intense Great Lakes clay plain basin	Andrew Binns	School of Engineering	PhD, In-Course Scholarship
Dharamdeo Singh	Survivability and persistence of Salmonella strains and serovars in low moisture foods and their control mechanisms	Lawrence Goodridge	Department of Food Science	PhD, In-Course Scholarship
Olivia Willoughby	Understanding the genes and metabolic pathways associated with the resistance of sheep to gastrointestinal nematodes and its climate change effects	Angela Canovas	Department of Animal Biosciences	MSc, Entrance Scholarship

Student Name	Project Title	Faculty Advisor	Department Name	Degree, Scholarship Type
Hannah Woodhouse	Identifying the major on-farm factors associated with elevated free fatty acids (FFAs) in dairy cows' milk	David Kelton	Department of Population Medicine	PhD, Entrance Scholarship
Brenda Zai	Control of salmonella and campylobacter in poultry production and processing through the application of novel technologies	Keith Warriner	Department of Food Science	MSc, In-Course Scholarship
Peter Zytner	Home compostable alternatives to single-use packaging from bacterial bioplastics and their biocomposites	Manjusri Misra	School of Engineering	MASc, Entrance Scholarship

Significant improvements were made to the application review process in 2021/22. Alliance program staff consulted with UofG staff involved in scholarship program administration, observed an Ontario Graduate Scholarship (OGS) adjudication meeting, and met with the Assistant Vice-President (Graduate Studies) to learn more about best practices in scholarship application review. As a result of these engagements, a new two-stage scholarship review process involving 'block reviews' was developed and utilized. This ensured each proposal was thoroughly discussed by a group of reviewers. Communication with reviewers during the review period and at the final review meeting was also improved, as was the approach to data analysis. These changes improved the process, were well received by reviewers, and, ultimately, ensured that the best qualified recipients received the scholarships. Finally, additional feedback about the process was obtained that will be incorporated next year.

In 2020/21, a policy was drafted to mitigate the impacts of COVID-19 on HQP Scholarship recipients. The policy recognized the importance of graduate students in supporting the Ontario Agri-Food Innovation Alliance Research Program and maintaining the University's reputation for research excellence. It also provided flexibility, certainty and supported the health and safety of the HQP Scholarship Recipients. The policy had non-financial supports (e.g., deferral of start date, leave of absence, allowance for other locations, etc.), which five students utilized, and financial supports, which twelve students benefitted from. Specifically, the Alliance provided COVID-19 support payments of $84K ($40K in 2020/21 and $44K in 2021/22) which was critical in assisting HQP Scholarship recipients.

Table 3.11 provides the status of each of the activities related to the HQP Scholarship Program identified in the 2021/22 Business Plan, as well as provides an update on any incomplete items from the 2020/21 Business Plan.

Table 3.11: Status Update on Business Plan Activities – HQP Scholarship Program

Business Plan Activity	Status
Improving awareness of the HQP Scholarship Program, both within the University of Guelph and external to it, with the goal of improving the quality of applications, finding students who are oriented to the importance of business in science and increasing the diversity of	Ongoing. The HQP Scholarship Program was advertised in a number of venues and through several communication channels (e.g., Townhalls, Research Alerts, direct emails to Department Administrators, Graduate Program Assistants, and Undergraduate Program Counsellors for distribution, etc.) at the University of Guelph. To generate interest outside of the UofG, an advertisement was sent to program coordinators of agricultural programs at other Ontario Universities (16 agriculture focused program coordinators across seven universities).

Business Plan Activity	Status
research areas of significance to the agri-food sector	
Continuing to work closely with Food from Thought staff to ensure that the collaboration provides benefit for both parties	Ongoing. Interactions occur regularly with Food from Thought staff to ensure the program is running smoothly for all parties. The HQP Scholarship program continues to effectively address the Agreement objective of supporting the development of highly-skilled, intellectual capacity to create future generations of researchers, policy-makers, and innovators in government, academia, the agri-food sector, and rural economic development. Likewise, the UNIV*6050 course and, in particular, the team challenge project, directly addresses the Agreement objective of establishing linkages between students and the agri-food sector to equip students to meet the changing demands of the workforce.
Developing an HQP Scholarship report review process and rubric	Complete. A new HQP Scholarship Program Reporting and Review Policy was developed and jointly approved. It has been implemented in RMS. The University utilized the new procedure for the first round of reporting in RMS in Summer 2021. A report review rubric has been developed that was used for reviewing reports starting Spring 2022. The HQP Scholarship Program Reporting and Review Policy (noted above) has been updated to incorporate the rubric questions, as well as additional detail relating to UofG staff roles and responsibilities. In addition, a separate HQP Report Review Rubric document has been developed that provides additional guidance for Research Program Coordinators and the Program Sponsor in their review of HQP reports. Finally, a tip sheet specific to HQP reports was created and circulated to the HQP Scholars. In addition, a "HQP Scholarship Program Report Submission - RMS Orientation and Reporting Tips" meeting was held for HQP Scholars that had reports due. Twelve students participated in this training opportunity.
Improving the use of RMS for the application, tracking and reporting aspects of the HQP Scholarship program	Complete. New tracking fields have been created in RMS to support effective monitoring of the program. In addition, workflows have been modified to align the report review processes in RMS with the new report review policy.
Continuing to develop the policy manual for the HQP Scholarship Program, which formalizes many of the policies applied to HQP Scholarship holders	Complete. The HQP Scholarship Program Guide acts as the policy manual for the HQP Scholarship Program. It is available on the on the Alliance website for students and faculty advisors. It is updated annually and continues to be an effective way of communicating policies to HQP Scholarship applicants and award holders. In 2021/22, an HQP Scholarship Program Administration Manual was developed to complement the Program Guide. It outlines the processes associated with communications, call launch and submission, transcript and application review, and the award phase.

Business Plan Activity	Status
Improving the transcript review process, in concert with the University's Graduate Program Assistants	Complete. In collaboration with the University Graduate Program Assistants (GPAs), a tip sheet was created to define the role of GPAs more clearly and to help ensure consistent and accurate transcript reviews across all departments. The process will continue to be examined as needed to support continuous improvement.
In partnership with Food from Thought and the Arrell Food Institute, continuing to refine the HQP course (UNIV*6050 Innovation and Entrepreneurship in Agri-Food Systems) and work experience components of the program, with input from UofG Faculty, OMAFRA staff and key industry partners	Complete. Changes to the program in recent years have been very positively received and the course has reached a 'steady state' where major development is complete. Continuous improvement will occur as items are identified. Please see below for feedback on the course/program.
Ensuring HQP students receive exposure to leadership opportunities in the agri-food sector during their involvement in the program	Ongoing. The UNIV*6050 course (Innovation and Entrepreneurship in Agri-Food Systems) continues to build the capacity of HQP Scholars in the areas of business development, communication, social innovation, project management, and entrepreneurship. The team challenge projects, that are part of the course, link interdisciplinary teams of students with industry, government, or NGO partners to address an agri-food issue. In their progress reports, HQP Scholars described the valuable skills (soft, as well as technical/scientific) and professional development opportunities they gained as a result of their participation in UNIV*6050 and their thesis research. The following are quotes from student reports: *"The HQP Scholarship Program contributed to my professional development by simultaneously broadening and refining my knowledge of the nature and extent of challenges faced by diverse stakeholders in the agri-food sector. In addition, I was able to network with industry and academic colleagues I would not have otherwise met. Finally, I was able to refine my teamwork, time management, and communication skills through the academic and professional development opportunities presented to me throughout the course of the HQP Scholarship Program."* *"The HQP Scholarship program contributed to my professional development in a myriad of ways, the course addressed what agricultural research and employment can look like in the private, public and academic sectors as well as investing in the interpersonal communication, teamwork and presentation skills that help you to navigate and succeed in all three fields."*

Business Plan Activity	Status
	"The experiential course of the HQP scholarship program is one of the most unique learning set ups I have ever been part of. The course provided me with the opportunity to collaborate with other graduate students from different academic fields and agri-food industry experts to solve an emerging, real-world problem."
Further refining the recognition event to ensure that it meets program objectives and emphasizes the three key elements of the program: innovation, science, and business	Complete. The 2021 HQP Scholars Event was held December 2, 2021. The event was refined, and the length was expanded to allow more time for the student presentations and breakout sessions. The event was well attended with 74 participants. Scholars were provided a certificate and an HQP Scholar social media badge they can use on various electronic platforms like LinkedIn.
Creating mechanisms to monitor the career progression of HQP scholars following graduation	Cancelled. While implementing the employment survey, a number of privacy concerns were identified, along with questions about data reliability.
Utilizing the HQP employment survey results to improve students' experience in the program	Complete. The survey results were analyzed and discussed with HQP course leaders. The information will be used to support continuous improvement.

3.1.4 Research Projects

3.1.4.1 Research Project Operating – Tier I

Committed to excellence in research and guided by the core values of impartiality, fairness, and integrity, the processes supporting the research funding programs administered by the University of Guelph provide rigor and accountability in proposal review, according to best practices in research program administration.

The Tier I Research Program continued to be administered as a one-stage call (Full Proposals only). This change has resulted in earlier award notifications which better align with the needs for graduate recruitment and field season preparation, as well as efficiency gains for researchers, review committee members, and program staff, without any significant impacts on proposal quality.

Upon receipt of OMAFRA's research priorities for 2021/22, the University launched the one-stage call for proposals in October 2020. Nine review committees were assembled that were comprised of OMAFRA staff (including the OMAFRA Research Director or alternate, OMAFRA manager or alternate and RIB Research Analyst), academics (including the UofG Research Program Director), and representatives from industry. The response to the call generated 107 Full Proposals (FPs), with a total ask of $15.6M. The number of proposals was a decrease from the previous year where 127 FPs were received. This decrease was attributed to the COVID-19 pandemic and the fatigue being experienced by researchers.

The proposals were evaluated against defined criteria that included alignment with research priorities, benefits to Ontario, value for money, quality of the science, sector engagement and the research team. Of the 107 FPs that were received and reviewed, 47 projects were recommended for funding following the review process, with six projects recommended if additional funding was available. The Ministry supported all 47 recommended projects plus two projects that were recommended if funding became available, resulting in 49 projects being supported with a total amount awarded of $6,961,342. Table 3.12 provides the breakdown of

proposals by status and research priority. A list of the 49 research projects awarded in 2021/22 is included in Table 3.13.

Table 3.12: Number of Proposals by Status and Research Priority Area

Research Priority	Number of Proposals Submitted	Number of Proposals Recom-mended	Number of Proposals Recommended if Funding Available	Number of Proposals Awarded	Amount Awarded
Animal Health & Welfare	31	18	1	18	$2,048,686
Competitive Production Systems	26	8	3	10	$1,564,434
Food Safety	5	0	1	0	$0
Innovative Product	9	3	0	3	$523,300
Plant Health & Protection	14	5	1	5	$742,060
Productive Land Capacity	0	0	0	0	$0
Soil Health	7	4	0	4	$591,500
Strong Rural Communities	2	2	0	2	$330,804
Sustainable Production Systems	6	4	0	4	$575,400
Trade, Market & Targeted Sectors	2	0	0	0	$0
Water Quality & Quantity	5	3	0	3	$585,158
Total	**107**	**47**	**6**	**49**	**$6,961,342**

Table 3.13: 2021/22 Tier I Research Projects

Lead Applicant	Project Title	Ministry Priority	Amount Awarded
Cathy Bauman	Investigating milk quality on Ontario dairy goat farms	Animal Health & Welfare	$149,615
David Renaud	Exploring the prevalence and identifying risk factors associated with Salmonella Dublin in Ontario dairy herds	Animal Health & Welfare	$71,300
Renee Bergeron	Evaluation of environmental and cow health and welfare benefits of compost bedded pack housing systems	Animal Health & Welfare	$122,893
Todd Duffield	Improving welfare and adding value to cull dairy cows through feedlot management	Animal Health & Welfare	$95,500
Bill Van Heyst	Impact of peat moss bedding on particulate matter and ammonia generation in broiler production	Animal Health & Welfare	$95,565
Zvonimir Poljak	Mitigation strategies for disruption of swine production in Ontario due to possible outbreaks of contagious diseases	Animal Health & Welfare	$68,500
Manjusri Misra	Biodegradable plastic truck liners for Ontario deadstock disposal	Animal Health & Welfare	$234,500
Brandon Gilroyed	Assessing above ground burial as a swine mortality management strategy in Ontario	Animal Health & Welfare	$197,900
Leonardo Susta	Transmission pathways of aquatic bird bornavirus for poultry species	Animal Health & Welfare	$67,249

Lead Applicant	Project Title	Ministry Priority	Amount Awarded
Zvonimir Poljak	Can we predict between-species spillover transmission of influenza viruses on the basis of their genetics?	Animal Health & Welfare	$37,500
Elijah Kiarie	Maternal and perinatal dietary supplementation with enzymatically hydrolyzed yeast cell wall: immunocompetence and growth performance of piglets and broiler chicks	Animal Health & Welfare	$125,788
Trevor DeVries	Exploring a non-antibiotic alternative to improve calf health, growth, and welfare	Animal Health & Welfare	$42,623
Robert Friendship	Investigating stillbirth and neonatal mortality in pigs	Animal Health & Welfare	$44,000
David Renaud	Exploring nutritional and non-antimicrobial methods to improve male dairy calf success through transportation	Animal Health & Welfare	$129,080
Andrew Peregrine	Utility of the carbohydrate larval antigen (CarLA®) saliva test to lower the risk of gastrointestinal parasitism in Ontario sheep flocks	Animal Health & Welfare	$92,335
Leonardo Susta	SARS-CoV-2 in mink: development of a vaccine and serological testing	Animal Health & Welfare	$98,408
Shayan Sharif	Manipulation of the gut microbiome for control of necrotic enteritis in chickens	Animal Health & Welfare	$183,000
Shayan Sharif	Development of vaccines against necrotic enteritis in chickens	Animal Health & Welfare	$192,930
Kim Schneider	Evaluating economic and environmental outcomes of N fertility management and incorporating supplementary annual forages in a cool-season perennial pasture operation.	Competitive Production Systems	$219,767
Istvan Rajcan	Marker assisted breeding for SCN and white mould at University of Guelph soybean breeding program	Competitive Production Systems	$135,000
Istvan Rajcan	Identification & integration of sudden death syndrome resistance genomic regions into Ontario-adapted food-grade soybeans	Competitive Production Systems	$150,000
Karl Peter Pauls	Molecular marker assisted selection for improved seed protein content in dry bean	Competitive Production Systems	$150,000
Eric Lyons	Adaptation mechanisms associated with survival under low-temperature flooding and ice encasement in Ontario winters	Competitive Production Systems	$99,500
Amar Mohanty	Innovative solution for compostable greenhouse plant supplies	Competitive Production Systems	$226,500
John Lauzon	Impact of timing, placement, and source of sulfur and nitrogen for field crops in Ontario	Competitive Production Systems	$132,835
Hugh Earl	Management and non-management factors determining soybean yield potential in Ontario	Competitive Production Systems	$151,000

Lead Applicant	Project Title	Ministry Priority	Amount Awarded
Bernard Grodzinski	Integrated management strategies for daily use of artificial lighting for year-round greenhouse, vegetable production of vining crops: tomatoes and mini-cucumbers	Competitive Production Systems	$139,800
John Cline	An innovative approach to thinning peaches for improved labour efficiencies, fruit quality and orchard economics	Competitive Production Systems	$160,032
Animesh Dutta	Chemical upcycling of agri-food resources to activated carbon	Innovative Products & Product Improvement	$196,900
Wael Ahmed	Energy-efficient pumping technology for sustainable food production systems	Innovative Products & Product Improvement	$240,000
Ian Tetlow	Enhancing functionality of potato tuber starch for industrial use by manipulating amylopectin branching frequency	Innovative Products & Product Improvement	$86,400
David Hooker	Modernizing management of true armyworm in Ontario	Plant Health & Protection	$119,100
Cynthia Scott-Dupree	Developing crop specific recommendations for biological control in cannabis sativa to improve the effectiveness of integrated pest management	Plant Health & Protection	$98,000
Rebecca Hallett	Semiochemical management tactics for Colorado potato beetle	Plant Health & Protection	$174,460
Mary Ruth McDonald	Identification and management of Pythium diseases of carrot	Plant Health & Protection	$150,500
Peter Sikkema	Innovative weed management strategies for control of emerging weed biotypes in dry beans - acceptable herbicide residues in beans for export markets	Plant Health & Protection	$200,000
Kari Dunfield	Novel approaches for assessing biological indicators of soil health	Soil Health	$240,000
Richard Heck	Delineating drainage class by in-field induction measurement of soil magnetic susceptibility	Soil Health	$75,000
Mary Ruth McDonald	Cover crops for improved soil management and soil health in the Holland Marsh	Soil Health	$165,000
Alfons Weersink	Policy options to enhance the sustainability of cropping systems in Ontario	Soil Health	$111,500
Leith Deacon	Rural response to disruptive events	Strong Rural Communities	$231,554
Wayne Caldwell	Assessing the capacity of municipalities (counties and regions) to respond to evolving rural and agricultural issues	Strong Rural Communities	$99,250
Silvia Sarapura	Understanding transitions in Ontario's potato sector - a study of key drivers to behaviour change in the uptake of sustainable BMPs	Sustainable Production Systems	$128,200

Lead Applicant	Project Title	Ministry Priority	Amount Awarded
David Huyben	Improving the growth, gut health and immune response of fish by feeding insects, pre/probiotics and fatty acids	Sustainable Production Systems	$85,200
Praveen Saxena	Commercial propagation and conservation of value added crops in Ontario	Sustainable Production Systems	$152,000
Brandon Gilroyed	Enhancement of renewable energy production (biogas) through biochar amended anaerobic digestion of poultry waste	Sustainable Production Systems	$210,000
Prasad Daggupati	Quantifying ephemeral gully erosion in Lake Erie basin using field experimentation and modeling	Water Quality & Quantity	$186,500
Jana Levison	Agricultural N loadings to hydrological systems: assessing the impacts of climate change	Water Quality & Quantity	$198,814
Ryan Prosser	Watershed-level evaluation of the efficacy of riparian buffers on reducing nutrient and pesticide loading to protect water quality and biodiversity in streams	Water Quality & Quantity	$199,844
Total			**$6,961,342**

In addition to administering the 49 new projects addressing important Ministry research priorities in 2021/22, the University continued to manage the post-award compliance and reporting requirements of 210 continuing Tier I research projects.

An *Impact of COVID-19 on the Alliance Research Programs* document was created in 2020/21 in response to the COVID-19 pandemic. It outlined a variety of methods being used to support researchers in enabling Alliance research projects to meet their objectives and deliverables. In situations where the original project objectives or deliverables may not be achievable within the project design or budget, an opportunity for the researcher to develop alternative options, which could include revisions to the deliverables, changes to the project design or additional funding were to be discussed, subject to OMAFRA approval. R/PM PMC approved additional funding for two projects in 2020/21 where the original project objectives or deliverables were not achievable within the project budget due to COVID-19. One project was approved by R/PM PMC to receive additional funding due to COVID-19 in 2021/22.

Table 3.14 provides the status of each of the activities related to Research Project Operating – Tier I identified in the 2021/22 Business Plan, as well as provides an update on any incomplete items from the 2020/21 Business Plan.

Table 3.14: Status Update on Business Plan Activities – Research Project Operating – Tier I

Business Plan Activity	Status
Actively supporting the Research Management System's (RMS) implementation and move to continual improvement	Ongoing. The University meets monthly with OMAFRA to support RMS development and improvement. While some progress has been made with RMS in 2021/22, there remain issues that still need to be addressed in the short-term. These include: • Inconsistent/Missing Workflows Related to Project Status • Project Close-Out • KTT Transactions • Research Centre Manager Portal

Business Plan Activity	Status
	• Research Program Director Portal • Implementation of the UofG's Financials • Documentation for System Users The University continues to experience ongoing issues with RMS. On a regular basis, aspects of the system cease to function or disappear entirely. RMS is hampering the University's ability to effectively and efficiently support the Research Program, as well as report on its outcomes.
Enhancing engagement of Research Program Directors and Ontario Agri-Food Research Centre Managers in Tier I Projects, especially through formal RMS portals	In progress. With the new priority setting process in use by OMAFRA, there is less interaction and collaboration between UofG Research Program Directors (RPDs), OMAFRA Research Directors and RIB Research Analysts than in the past. To increase interaction, a virtual Meet and Greet between the RPDs and OMAFRA Research Directors took place November 20, 2021 in advance of the Tier I call. This was also used as an opportunity to outline the proposal review process and clarify roles and responsibilities for the review panels. The University is also enhancing engagement of the RPDs through RPD Portal in RMS. Developed in 2020/21, it provides basic functionality. Enhancements are desired by the UofG to improve access to project information and further support RPD involvement in the research administration cycle. The Research Centre Manager Portal is partially complete but requires additional development planned for 2022/23. A business needs document has been developed by the UofG to support next steps for portal development.
Continuing development and implementation of Research Project policies and administrative procedures, including relevant financial policies and policies related to end of project decisions	Ongoing. Various policy and administrative procedure documents were completed and/or approved in 2021/22 including: • Lead Applicant and Co-Applicant Policy • Issues Resolution Policy • Report Review Policy • Call Phase Activities Procedure • Submission Phase Activities Procedure • Review Phase Activities Procedure
Analyzing the touchpoints of program staff, including OMAFRA staff, in Research Project administration, utilizing value- and risk-based approaches, with the goal of improving efficiency while maintaining program excellence	Ongoing. Regular joint OMAFRA-UofG Management meetings are used to share information, discuss policy and process development, and manage project issues. To improve efficiency and timeliness, OMAFRA is piloting a single Research Analyst report review model. Report review timeliness and the outcomes of the pilot will be discussed further in 2022/23.

Business Plan Activity	Status
Improving the efficiency and quality of the application process, the proposal evaluation scorecard, the proposal review process and the report review process for all Research Projects	Ongoing. A significant review of program processes has occurred over the past few years and numerous policy and process documents have been developed. These are documented in various other rows of this table. Notwithstanding RMS upgrades/development identified elsewhere, Alliance Tier I Projects are nearing steady state for application, proposal evaluation, and report review processes. However, incremental areas for improvement will continue to be identified and implemented.
Developing a rubric for compliance checks for both proposals and reports	Complete. Compliance check rubrics for proposals and reports have been developed and are currently in use by program staff. In general, significant improvements in the compliance check process, specifically at the OR-5 stage, have led to better proposals moving into panel review process.
Creating a post-approval area of the Alliance website to assist Faculty Members in managing their Research Projects following award	Complete. The Alliance website has been updated with an Ontario Agri-Food Innovation Alliance - Resources for Researchers webpage. New content includes: • Amendment Requests • Quick Tips: Preparing your Tier I Proposal • Quick Tips: Preparing your Report
Continuing to improve the quality of the program guide and the training provided to Faculty Members and University approvers to support them in the application process	Complete. The program guide was updated to make it more comprehensive and relevant to researchers. Program staff continued to provide ongoing support to researchers throughout the research cycle. Specific activities in 2021/22 included: • A Proposal Development Workshop was held where program staff and RPDs provided advice and answered questions about proposal development. Thirty researchers took advantage of this opportunity. • Virtual Office Hours were offered to researchers to provide 'drop in' support for developing their proposals. This was a new initiative in 2021/22. • Compliance Checks were offered to researchers before they submitted their Tier I proposal to improve the completeness and quality of the submission. • An Approver Tip Sheet was updated and circulated to all approvers of Tier I proposals (Chairs/Directors and Associate Deans/College Research Managers). Approvers were also offered one-on-one training.
Developing rubrics for the report review process to assist with timeliness and consistency and reduce the delays in providing feedback to Faculty Members	Complete. The Report Review Policy was finalized and approved. Its purpose is to support the timely review of annual and final research progress reports that appropriately balance information needs with the reporting expectations placed on lead applicants. It contains rubrics and timelines for each stage of the review process and outlines how decisions are made on reports.

Business Plan Activity	Status
	Discussions with OMAFRA on the report review process are needed to ensure consistency in review and timeliness of feedback to researchers.
Refining the Issues Resolution process and ensuring that it is running effectively for administration of projects that are experiencing difficulties	Complete. The Issues Resolution Policy has been finalized and approved. The Issues Resolution process is being followed for projects that are experiencing difficulties. More details on issues resolution can be found in Section 3.2.2.4.
Analyzing the potential for a formal industry review process, similar to peer review	Complete. An industry review process was discussed at a joint OMAFRA-UofG Management meeting. Status quo will be maintained for the Livestock Research Innovation Corporation's (LRIC) industry review. Expansion of the industry review process to other panels is not being considered at this time. In addition, the current state of RMS development would not support expansion.
Enhancing the method of recording Knowledge Translation and Transfer (KTT) activities (KTT Tracker) and promoting its use among Faculty, even post final report	In progress. The issues with the KTT Tracker are still not resolved which prevent both fulsome reporting from researchers and program-level analysis of KTT. UofG and OMAFRA have met to discuss the current state and expected functionality of this element of RMS. OMAFRA is working with the RMS vendor, Smart Simple, to resolve the issues and improve functionality. Until these issues are resolved the University cannot broadly promote its use to researchers.
Developing an Equity, Diversity, and Inclusion (EDI) policy and collecting EDI information for applications to all Research Projects to better understand who the applicants are and determine if there are any systemic barriers that need to be addressed	In progress. As part of the renewal process, an Ontario Agri-Food Innovation Alliance EDI Advisory Group has been formed. Their mandate includes developing an EDI Statement and Action Plan. EDI policies related to Research Projects will stem from those activities. During 2021/22, a general EDI question, asking applicants to briefly describe how their project will support, enhance and/or take into consideration EDI, was added to the proposal template in RMS to establish a baseline of the capacity and understanding of EDI practices by the research community. This information is currently being analyzed and will be shared with a joint OMAFRA-UofG Management group shortly. RMS limitations and concerns about confidentiality have paused the collection of applicant-specific data at this point in time. Ms. Joanne Garcia-Moores joined the Office of Research Agri-Food Partnership and the Office of Research Services as the Indigenization, Equity, Diversity, and Inclusion Advisor in Research on April 18, 2022. Ms. Moore's appointment will significantly increase the University's capacity to address IEDI challenges in research.
Promoting and creating opportunities for productive research collaborations that connect colleagues, disciplines, and a diversity of partners to better address the new research priority areas	Ongoing. The following opportunities for research collaboration were promoted in 2021/22: • Discovery and Dialogue Meetings, which were an opportunity for faculty to learn more about OMAFRA research priorities by interacting with OMAFRA specialists. • A meeting with Department of Food, Agricultural and Resource Economics (FARE) and Lang School of Business which promoted

Business Plan Activity	Status
	the Tier I Call and discussed relevant research questions. Seventeen faculty members attended. • Outreach to the One Health Institute. Research questions relevant to One Health were identified in the priorities and shared with the Institute. An offer was made to schedule a meeting, but it was not accepted. OMAFRA's new focus on One Health was highlighted in the Tier I Townhall presentation and the call was advertised in the One Health newsletter. Research questions that are more reflective of One Heath principles would be beneficial. • Outreach to the College of Engineering and Physical Sciences (CEPS). Relevant research questions were sent to the CEPS College Research Manager for distribution to their faculty. In future years, a meeting to further engage CEPS faculty would be valuable.
Working with the Ministry to address the asynchrony between the Ministry's provision of research priorities and the research call cycle, as well as the timeliness of program decisions	In progress. There is still work to be done on aligning the provision of research priorities to the optimal research call cycle timing. Given that the delivery of new knowledge addressing the priorities arises towards the end of multi-year projects, UofG continues to advocate for programs to be administered according to the most appropriate timelines for optimal research outputs using the priorities available at the time. Such asynchrony would have no significant impact on the relevance of the research. Research projects for unanticipated priorities can be quickly mobilized through Special Initiatives programming (see Section 3.4.1.2). Meeting deadlines for the research priorities and ministry project approval also continued to be a challenge. For the 2022/23 call cycle, priorities were delivered by OMAFRA two weeks past the planned launch date of the call, but earlier than in past years. While priorities were provided earlier, it still put pressure on the review process. Ministry approval of funding recommendations was expected on or before February 14, 2022, with notification planned for the same day. Approval was provided February 28, 2022, and there was an additional delay in notification due to the request for a letter from the Minister to be sent to successful applicants. Applicants were notified on March 10, 2022.
Beginning discussions with OMAFRA about strategic opportunities in the Research Projects Program Activity	In progress. Some initial discussions were held at a joint OMAFRA-UofG Management meeting. However, it is expected that this activity will predominately occur as part of the renewal discussions.
Identifying third-party incremental leverage opportunities for Research Projects through external relationship building with industry and potential donors	Ongoing. The NSERC Alliance program was identified as a significant third-party incremental leverage opportunity for Tier I Research Projects. RIO worked with researchers to link them to industry funders and support the NSERC Alliance application process. Nine projects involving OMAFRA as a Partner or including OMAFRA funds as leverage were approved in 2021/22, generating $2.9M from the NSERC Alliance program.

Business Plan Activity	Status
Developing guidelines for Faculty Members interested in leveraging Research Project funds through the NSERC Alliance program	Complete. Office of Research Agri-Food Partnership staff have worked with OMAFRA and RIO to develop an approach to leverage NSERC Alliance Funding. An NSERC Alliance guidelines document has been developed and shared with researchers as appropriate. UofG researchers work directly with OMAFRA specialists (who are team members on their proposal) to provide input to NSERC's 'Partner Organization Form'. The guidance document will be periodically reviewed and updated as needed.
Analyzing the application and proposal review processes to ensure they create an environment that is supportive of leveraged projects	Complete. The application and proposal review processes were examined to determine how they treat leverage in projects. Leverage and partnerships are key criteria for proposal review and are an important part of review panel discussions. Applicants can provide letters of support and confirmation of leveraged funding throughout the review period so current information is available at the panel meetings. In addition, to support leveraged projects, some flexibility has been built into the research project administration of Tier I projects to align with other funders and capitalize on significant cash leverage, including leverage secured throughout the project (after award). Program staff work closely with researchers to update their project records to capture new leverage sources. Some policy and processes have been developed to support this. Finally, it is important to note that there will always be significant differentials in leverage across research priority areas.
Focusing on communications related to Research Project outcomes and the impact research is having on the end users	Ongoing. Significant advances continue to be made in designing and delivering new communications tools to expand reach and awareness of Alliance-funded research. The third Research Impact Case Study, focused on Innovation, was completed in June 2021. The case study highlighted research impacts on the bioeconomy, craft brewing sector, farmland preservation, and farmer mental health, as well as exploring entrepreneurship and start ups associated with the Alliance. A new Impact section of Alliance website was launched in 2021/22. Content draws from the three Research Impact Case Studies (Dairy, Breeding and Genetics, and Innovation) and similar assessments for the other program areas of the Agreement – the Agriculture and Food Laboratory, Animal Health Laboratory, and the Veterinary Capacity Program. Please see Sections 1.6.1 and 3.1.7 for more details about the affect the Impact section of the Alliance website is having.
Enhancing communication and collaboration with the Research Innovation Office and the Office of Research Services to ensure uniform application of University research policies and	Ongoing. 2021/22 has seen enhanced communication and collaboration with the Office of Research Services (ORS) and the Research Innovation Office (RIO). Regular meetings have been established with ORS to discuss issues of common interest. Areas for enhanced collaboration have been identified and sharing of program, project and policy/process information is ongoing. For example, discussions related to third-party agreements and data access are underway with ORS. The outcome is greater

Business Plan Activity	Status
to expand opportunities for leverage	coordination related to partner/co-funder agreements and assurance of compliance with the Agreement. In addition, there has been increased interaction with RIO on the development of the approach to leverage NSERC Alliance funding with OMAFRA Tier I or Tier II support.

3.1.4.2 Research Project Operating - Special Initiatives

Projects funded under the Special Initiatives (SI) program respond to a specific issue or need of the Ontario agri-food sector that has been identified by OMAFRA. These science and research needs are important for the Ministry and agri-food stakeholders but, for various reasons, do not fit well into the annual Tier I call for proposals cycle or under another Alliance or OMAFRA program. Special Initiatives include breeding research, medium-term trials, synthesis, modelling work, and other Ministry science needs.

In 2021/22, two new SI projects received funding, while four existing projects were amended to provide additional funds. The six 2021/22 Special Initiatives Projects are shown in Table 3.15 below.

Table 3.15: 2021/22 Special Initiatives Projects

Lead Applicant	Project Title	Research Priority	Amount Awarded
Spencer Henson	Establishing an Ontario food panel: tracking public attitudes and behaviour post-COVID-19	Trade, Market & Targeted Sector Growth Opportunities	$225,000
Cheryl Trueman	The effects of Three Sisters on insect diversity, abundance and the related effects on plant health and crop yield	Sustainable Production Systems	$55,000
New Projects			**$280,000**
Brady Deaton	Farmland values and farmland rents data for Ontario	Productive Land Capacity	$180,000
Thomas Graham	Characterization of nuisance stray light, and evaluation of abatement strategies on crop productivity, in year-round greenhouse production	Sustainable Production Systems	$45,000
Alan Ker	Commodity-specific economic modeling	Agricultural and Rural Policy	$300,000
John Zandstra (Katerina Jordan)	Improvement of Ontario hazelnut cultivars focusing on winter hardiness and pest tolerance, with an emphasis on management of Eastern Filbert blight	Plant Health & Protection	$40,000
Existing Projects			**$565,000**
Total			**$845,000**

In addition, at the R/PM PMC meeting on August 26, 2021, a scope change and extra funding was approved for the SI project *Odour quantification and mitigation from cannabis production facilities in Ontario*. This was to address outcomes not achieved in a terminated Tier I project. The expansion of scope was handled as an amendment to the original SI project and the award amount was increased by $141,900.

Table 3.16 provides the status of each of the activities related to Research Project Operating – Special Initiatives identified in the 2021/22 Business Plan, as well as provides an update on any incomplete items from the 2020/21 Business Plan.

Table 3.16: Status Update on Business Plan Activities – Research Project Operating – Special Initiatives

Business Plan Activity	Status
Working with OMAFRA, to clearly identify the differences between SI Projects and Tier I Projects and to ensure that the SI Projects help to fulfill the objectives of the Research Program as outlined in the Agreement	On hold. It is expected that this activity will occur during the renewal discussions.
Continuing to develop policies and processes to support Special Initiative Projects	Complete. SI projects have been fully implemented in the RMS. A program guide has been developed to support researchers in their understanding of the program and the proposal process.
Supporting and improving the timeliness of Special Initiative award allocations	On hold. OMAFRA informed the University that the SI program was paused. All SI projects that were awarded in 2021/22 resulted from unique requests rather than a general call.
Considering opportunities to use Special Initiative funds as leverage to other programs on an individual basis to improve likelihood of success, multiply the impact of Agreement funds and address OMAFRA priorities	In progress. The University is searching for opportunities to use SI funds to leverage other programs for the benefit of the agri-food sector. When a clear opportunity arises, it will be brought forward to R/PM PMC for discussion.
Discussing the use of Special Initiatives to address specific research questions at the Research Centres to drive utilization rates	In progress. Limited progress was made on this activity in 2021/22, as the status of the SI program was unclear. The University will be meeting with RIB to discuss this possibility in 2022/23.

3.1.4.3 Undergraduate Student Experiential Learning Program

The University of Guelph is responsible for administering and managing the Undergraduate Student Experiential Learning (USEL) Program which supports students in the development of leadership skills, enhanced written and verbal communication skills, applied research, and project planning and management to better equip them to engage in effective agri-food knowledge mobilization.

The USEL Program gives third-year undergraduate students work experience in the agri-food sector. Students are partnered with mentors to complete an agri-food research project that supports producers and rural communities. In 2021/22, the USEL Program included ten students and involved projects from the Agriculture Development Branch, the Environmental Management Branch, and the Food Safety Systems Development Branch. Table 3.17 shows the student names, project titles, and mentors for 2021/22.

Table 3.17: 2021 USEL Program Students and Projects

Student Name	Project Title	UofG Mentor(s)	OMAFRA Mentor(s)
Jeremy Vandenhazel	Contributions of bedding plants grown by Ontario greenhouses to pollinator protection in urban areas	Alan Sullivan - Department of Plant Agriculture	Sarah Jandricic, Jennifer Llewellyn - Agriculture Development Branch

Student Name	Project Title	UofG Mentor(s)	OMAFRA Mentor(s)
Elena Lee	Investigation of microplastic residues in soil from plastic mulch use in horticultural crops	Animesh Dutta - School of Engineering	Mahendra Thimmanagari - Agriculture Development Branch
Riley McConachie-Chara	Characterization of winter and spring wheat breeding lines to Fusarium Head Blight (FHB) disease	Helen Booker - Department of Plant Agriculture	Joanna Follings – Agriculture Development Branch
Joshuia Moran	Advancing milk quality and animal management in Ontario's composting bedded pack dairies	Renee Bergeron - Department of Animal Biosciences	Christoph Wand, Tom Wright – Agriculture Development Branch
Jessica Kelly	Repurposing dairy processing waste as a feed ingredient for feedlot cattle	Katie Wood - Department of Animal Biosciences	Megan Van Schaik – Agriculture Development Branch, Peter Doris - Environmental Management Branch
Hannah Michaels	Body condition score influence on colostrum production and quality in small ruminants	Niel Karrow, Michael Steele - Department of Animal Biosciences	Marlene Paibomesai, Delma Kennedy – Agriculture Development Branch
Megan Smith	Innovative digestion for nutrient recovery and reduction of microplastic	Sheng Chang – School of Engineering	Anna Crolla, Ping Wu - Environmental Management Branch
Michaela Nenadovich	Utilization of cheese whey for various products	Bassim Abbassi – School of Engineering	Ping Wu, Anna Crolla, Peter Doris - Environmental Management Branch
Martin Holysh	Remote inspection	Hari Simha, Mohammad Biglarbegian – School of Engineering	Ping Wu, Environmental Management Branch
Giulia Kobylnik	Food safety intervention systems	Keith Warriner - Department of Food Science	Jeanine Boulter-Bitzer - Food Safety Systems Development Branch

Students led the agri-food research projects from start to finish and participated in virtual industry and/or OMAFRA events to present project findings (e.g., Blackburn radio reports; ag breakfast meetings with farmers; Wheat Industry Day; UofG Field Day; Ontario Cheese Factories, Maple Dale and Empire; Dairy Industry Updates; Ministry of the Environment, Conservations and Parks; Flowers Canada poster; Environmental Science and Engineering Webinar; Environmental Management Branch Talks sessions; and Ontario Fruit and Vegetable Convention). In addition, most students developed several KTT products, such as articles, posters, fact sheets, infographics, radio reports, blog postings, etc.

The USEL 2021 exit survey was completed by all ten students. The survey showed:

- 80% of participants were very satisfied with the overall USEL program;
- 60% of participants indicated that they know quite a bit about KTT and 40% know a little bit about KTT, compared to 10% at the beginning of the program;

- 80% of participants indicated they have a better understanding of the Ontario agri-food system;
- 60% of participants identified that the USEL program would definitely influence their academic prospects or future career plans, while 30% indicated it would possibly influence their academic prospects or future career plans; and
- 70% participants indicated USEL program met their agriculture and food work experience goals.

USEL students indicated some of the benefits from participating in the program included:

- Responsibility of running a project with minimal supervision;
- Field work;
- First-hand experience talking to stakeholders and laboratory experience;
- Working one-on-one with an experienced researcher;
- Being involved in decisions about where the project is going and being able to give suggestions to improve lab results;
- Obtaining work experience in data collection, analysis, and interpretation;
- Increased confidence in public speaking;
- Taking an active lead in designing the experimental process which enhanced project management skills;
- Talking directly with producers and being hands on on-farm, including getting to see how the work benefits the sector;
- Conducting interviews about topics with little knowledge, being taught how to target questions and document results that would further understanding and therefore contribute more to the project;
- Learning how to transfer the information/knowledge to producers; and
- Networking opportunities available throughout the summer led to a research project for fourth year with a UofG Professor and potential opportunities for a master's project.

Table 3.18 provides the status of each of the activities related to the USEL Program identified in the 2021/22 Business Plan, as well as provides an update on any incomplete items from the 2020/21 Business Plan.

Table 3.18: Status Update on Business Plan Activities – USEL Program

Business Plan Activity	Status
Ensuring that the appropriate USEL application and reporting templates exist in RMS and that they are used at the appropriate times	Complete. The USEL project record and report templates were developed in collaboration with OMAFRA's Program Lead and RIB and have been implemented in RMS. In addition, reports for 2021/22 projects have been recorded in RMS. OMAFRA mentors are currently working on inputting project records for the 2022 intake of USEL students.
Developing a program guide and relevant training materials for the USEL Program	Complete. A tip sheet for OMAFRA Mentors and USEL students has been developed, which also serves as the program guide. A presentation to mentors and students took place May 2, 2022 to orient them to RMS and show them how to input project information and complete a final report.
Analyzing the feasibility of using RMS to manage the entire USEL process, including applications from OMAFRA staff and potential student employees	Complete. The UofG discussed expanding the use of RMS to administer all aspects of the USEL program with OMAFRA. OMAFRA's preference is to continue with the status quo.

Business Plan Activity	Status
Encouraging additional faculty members from different departments (e.g., the School of Engineering) to become involved with the USEL Program, especially given the participation of additional Branches of the Ministry	Complete. Several faculty members from the College of Engineering and Physical Sciences – School of Engineering participated in the USEL program in 2021/22 for the first time. The University also highlighted the USEL program in a recent newsletter and press release on the Alliance website to generate more interest. Finally, OMAFRA's USEL Program Lead has indicated that they are satisfied with the current level of outreach and engagement of faculty members.
Recording historical USEL project data into RMS, so that all projects that are part of the current OMAFRA-UofG Agreement are in the system (2020/21)	Complete. This task was finished in 2021/22 for all projects associated with the current Agreement.

3.1.5 Research Innovation Office

The Ontario Agri-Food Innovation Alliance supported UofG inventions that had impact across the agri-food sector. RIO is responsible for managing and administering research innovation and commercialization programming for the University of Guelph. Despite some challenges (COVID-19 kept staff away from campus for most of the reporting period), RIO had another successful year in the development, commercialization, and advancement of technologies and projects that will benefit the Ontario agri-food economy.

Products reaching the market have an opportunity to disrupt a number of industries in new ways. For example, the *In The Know* mental health literacy program developed for the agricultural community has been licensed to providers across the country and was delivered to numerous participants in 2021/22.

The germplasm portfolio had a strong year, though revenue was down slightly from last year. The first wheat variety developed from the reconstituted wheat breeding program will be made available to farmers for planting in 2022. Reported disclosures were also down because soybean disclosures were not submitted prior to the yearend cut-off.

New reports of invention unrelated to germplasm were back up this year, including new bioproduct technologies, animal feed additives, and decontamination systems.

The Gryphon's LAAIR program, administered by RIO, continued to help faculty work with industry to de-risk commercially viable early-stage technologies. A Gryphon's LAAIR award to Dr. George van der Merwe helped to develop products for the start-up company Escarpment Labs, which is growing in both employees and sales. Dr. van der Merwe and his team were the recipients of a UofG Innovation of the Year award in 2021/22.

The Industry Liaison (IL) team had a very big year with 41 funded projects receiving more than $19M, including more than $9M awarded to projects in the dairy space led by Dr. Giselle LaPointe and Dr. Stephen LeBlanc. The IL team helped to successfully leverage OMAFRA funding with the federal NSERC Alliance program, where OMAFRA is a partner on the team. Nine projects were successful in 2021/22, building on success from the previous year. More details can be found in Section 3.4.2.

With an ongoing priority to build capacity and develop programming that promote and support a culture of innovation and entrepreneurship, RIO has continued to develop partnerships on and off campus to bolster its

service offerings to the University's research enterprise. Specific focus has been applied to Intellectual Property (IP) education opportunities for faculty, graduate students, and staff. During this reporting period, RIO released an online IP Education module for use by the campus community and created and published its first 'Commercialization Framework', which outlines the institution's campus-wide commitments to help commercialize IP arising from its research programs. The Framework was developed in consultation with key stakeholder groups on campus including the Research Advisory Board, Office of Research, Vice-President's Academic Council, Community Engaged Scholarship Institute, and the John F. Wood Centre for Business and Student Enterprise. Additionally, RIO played a critical role in inter-institutional alignment as the collective frameworks were posted. The IP Education Program has seen 90 enrolments to-date, most of which are graduate students and staff. Overall, the module has been well-received by those completing the course (rated good through excellent in terms of overall usefulness in increasing understanding of topic area). Surveys to date also indicate a high level of interest for a follow-up module on IP strategies.

With the recent hiring of the Assistant Vice-President, Research Innovation and Knowledge Mobilization, RIO has spent considerable time over the last year reviewing and evaluating strategic and tactical plans related to operations, data management and reporting mechanisms, and commercialization support programs such as Gryphon's LAAIR. In 2022/23, RIO looks forward to building on a strong foundation and leveraging support from the Alliance to both increase and communicate research impact.

Table 3.19 provides the status of each of the activities related to RIO identified in the 2021/22 Business Plan, as well as provides an update on any incomplete items from the 2020/21 Business Plan.

Table 3.19: Status Update on Business Plan Activities – Research Innovation Office

Business Plan Activity	Status
Familiarizing the new Assistant Vice President, Research Innovation and Knowledge Mobilization, Jessica Bowes, with the work of the Ontario Agri-Food Innovation Alliance	Complete. Ms. Bowes joined the University in February 2021 with a mandate to elevate the University's efforts to promote research innovation. She is fully informed on the work of the Ontario Agri-Food Innovation Alliance and has been actively involved in R/PM PMC meetings.
Reviewing and possibly implementing any relevant recommendations from the Expert Panel on Intellectual Property	In progress. As a result of the Expert Panel, the Province required all universities and colleges to post a Commercialization Framework document by April 29, 2022. The UofG's document is available online at University of Guelph - Commercialization Framework. The UofG will also be required to report on activities each fall, and the Province has created a new agency, called IP Ontario, that will endeavor to support the growth of IP assets across Ontario.
Developing / borrowing / implementing tools and education programs designed to increase IP literacy on campus	Complete. RIO released an online IP Education module for use by the campus community, which has seen 90 enrolments to-date, most of which are graduate students and staff.
Continuing to cultivate relationships with Venture Capital (VC) investors in support of both new IP and start-up companies	Ongoing. RIO is in regular discussions with VCs and angel investors such as Carrot Ventures and SVG THRIVE. A recent example is a small pilot event which was held with other local universities to present technologies to investors and possible founders to promote the creation of more stable start-up companies. Additionally, RIO was engaged to facilitate introductions between investor firms and UofG's team responsible for development of a Canada First Research

Business Plan Activity	Status
	Excellence Fund (CFREF) 2.0 Letter of Intent. RIO also facilitated an investor networking event with Emmertech (Saskatchewan), as part of on Ontario-wide tour for the managing partner. Finally, RIO is collaborating with Innovation Guelph to co-host an event, which is scheduled to take place in June 2022 in Guelph.
Continuing to improve collaboration with ARIO	Ongoing. Systems for communication, information sharing, and reporting between RIO and ARIO have improved each year of the Agreement. Ongoing, regular consultation at the finance level and with the AVP, Research (Innovation & Knowledge Mobilization) have also contributed to the improvement. Over the last year, ARIO and RIO have worked together on recruiting activities for the Technology Transfer Manager - Germplasm and the Finance Officer positions, as well as on reflection activities related to financial reporting processes/templates.
Improving the utilization of tools, including PatSnap, a patent search and analytics tool, and In-Part, a match-making service for universities and companies	Ongoing. RIO has renewed subscriptions to PatSnap and offered regular training to staff. RIO has also undertaken a working group to improve file integrity and utilization of the Inteum/Minuet database tool across technology transfer operations.
Enhancing and focusing on communication, including developing guides and presentations to help streamline messages to different audiences and add value	In progress. COVID-19 has been limiting for RIO in terms of communication and presentations, but it is an increasing focus as there is a return to more in-person interaction. The Commercialization Framework consultation is a recent example of how RIO has developed presentations to communicate service value to the ecosystem. RIO also played a vital role in establishing an opportunity for OMAFRA RIB staff to learn about UofG's approach to safeguarding research. Although this did not result in the development of guides, it is an important example of information sharing. RIO has been approached to help identify and communicate UofG entrepreneurship guidelines to better support college administrators in their effort to empower entrepreneurial activity. Although this work is still in the early stages, it is flagged as an area of interest in the year ahead. Finally, RIO has been involved in broader Office of Research effort to improve research communications. This is an ongoing project that will carry over into next year and is anticipated to result in enhanced RIO website content and structure.

3.1.6 Gryphon's Leading to Accelerated Adoption of Innovative Research

In 2021/22, funding from the Gryphon's Leading to Accelerated Adoption of Innovative Research Program (Gryphon's LAAIR or GLAAIR) was used to provide support for six researchers to de-risk technologies. It also funded a pitch and virtual demonstration event (Showcase) designed to assist UofG's research-based start-ups engage with industry to adopt and move their technology closer to market applications.

Two Gryphon's LAAIR projects, totalling $39,995, focused on economic analysis and market validation to help quantify the most attractive market opportunity before seeking further investment from government or

corporate sponsors. These are shown in Table 3.20. Market Validation projects are critical to help researchers quantify the size and feasibility of the most viable 'first product' based on the needs and feedback of end-users in Ontario. One project developing healthy low sugar baking food products, with a Technology Readiness Level (TRL) 5, planned to conduct extensive sensory testing with consumers and determine consumer purchasing wants and needs. Another project planned to conduct a market analysis of partners and stakeholders in the consumer food safety retail space to determine how a new COVID-19 decontamination device might be used by retail chains such as Tim Hortons and Starbucks.

Table 3.20: 2021/22 Gryphon's LAAIR Projects – Market Validation

Lead Applicant	Project Title	Research Priority	Amount Awarded
Lisa Duizer	Market validation through customer-focused sensory analysis of functional bakery goods	Innovative Products & Product Improvement	$19,995
Keith Warriner	Market validation of a portable hydroxyl-radical unit for surface decontamination of food and non-food surfaces and shelf-life extension of fruit & vegetables	Food Safety	$20,000
Total			**$39,995**

Four Gryphon's LAAIR projects, shown in Table 3.21 and totalling $372,500, focused on advancing commercial development of a Minimum Viable Product (MVP). These Product Development projects, with TRLs ranging from 3 to 6, were funded to support the development, building, and optimization of prototypes to demonstrate to prospective industry partners. Two projects are making strong connections with their industry partners, who also happen to be UofG spinoff companies supported previously by RIO and Alliance funding. Dr. Gopinadhan Paliyath is working with Psigryph Inc., which has recently secured equity financing. Dr. George van der Merwe is working with Escarpment Labs, which is currently experiencing a significant growth in sales.

Table 3.21: 2021/22 Gryphon's LAAIR Projects – Product Development

Lead Applicant	Project Title	Research Priority	Amount Awarded
Wael Ahmed	Gaslift pumping technology for moving heavy fluids and mixtures in food systems	Innovative Products & Product Improvement	$100,000
Gopinadhan Paliyath	Nanopect-RNA adducts for RNA-therapeutic and RNA vaccine delivery for animal and human health protection and disease prevention	Animal Health and Welfare	$100,000
Rafael Santos	Validation and certification of engineered slow-release carbon-sequestering fertilizers	Innovative Products & Product Improvement	$89,000
George van der Merwe	Developing Ontario lager yeasts	Innovative Products & Product Improvement	$83,500
Total			**$372,500**

Updates on Past Projects

Previously, Gryphon's LAAIR supported market research on single-use biodegradable culture vessels for plant propagation and cloning of new disease-free grape plants needed by growers in the Niagara region. This initial research helped Dr. Praveen Saxena secure additional Gryphon's LAAIR funding (starting in 2022/23) to develop industrial protypes for testing in collaboration with their industry partner, Upper Canada Growers, who produce over 2.5M fruit trees annually. The Gryphon's LAAIR program is helping to strengthen partnerships that facilitate the adoption of new technology to reduce costs and improve quality in the Ontario wine and grape industry.

Neophyto Foods is a UofG spinoff company founded by graduate students to make plant-based alternatives to meat and dairy products. Neopyhto previously marketed a soy-based cheese for vegetarian consumers with the help of Dr. Art Hill and the Gryphon's LAAIR program. Since then, Neophyto has launched a soy and chickpea-based ground meat alternative product that is selling well. In addition, Neophyto has won several pitch competitions in the last five years and continues to grow with the support of various organizations, including RIO, MaRS, McGill Incubator, and Innovation Guelph.

Harvest Genomics, a previous winner of the Pitch Competition, is growing sales more quickly than expected and has received additional funding from Bioenterprise to accelerate new product offerings.

Another UofG spinoff, eQcell, is an equine stem cell company created by Dr. Thomas Koch with the help of RIO, Accelerator Centre-Waterloo, and the Gryphon's LAAIR program. In 2021, eQcell raised $4.8M in equity financing and are the first company to be authorized by Health Canada to test mesenchymal stromal cells for treating equine arthritis.

Previous support from the Gryphon's LAAIR program enabled Dr. Julang Li to explore and navigate the Canadian regulatory system for a new product to aid piglets to safely wean early. This new product falls under a new category (Novel Feed Supplements) created by CFIA to support industry innovation in a new field called 'gut modifiers'. RIO applied to CFIA for approval which could result in this product being one of the first in Canada to be approved under this new regulatory pathway in animal nutrition.

May 2021 Pitch Competition and Showcase

The Gryphon's LAAIR Innovation Showcase and Pitch Competition strives to give industry and financial leaders a 'first look' at the value propositions of emerging agri-food companies founded on University of Guelph research.

With the continuation of the COVID-19 pandemic, the Innovation Showcase and Pitch Competition was once again delivered virtually in May 2021. Five start-up companies with roots in University of Guelph laboratories were recruited to pitch their businesses online using social media. Likewise, presentations and interviews about agri-food innovation and entrepreneurship were delivered from past Gryphon's LAAIR projects. In the Pitch Competition, the first-place award was given to Obi-Vet, which delivers continuing education to veterinarians using an innovative microlearning platform. The People's Choice Award was given to Digi Track, a digital tracking service to help food manufacturers manage food safety recalls using their innovative software.

In the spirit of continuous improvement, a new showcase format was tried this year, in which the audience was directed to watch the pitches and showcase talks asynchronously in advance of the award ceremony. Significant social media engagement was achieved using these posts in advance of the event. Unfortunately, the event/ceremony itself was poorly received and confusing to most of the online audience. Feedback received clearly indicated a need to reassess the audience's and stakeholder's (industry, investors, and entrepreneurs) wants and needs so that future events are aligned.

An initial proposal was submitted to RIB outlining an opportunity to pilot an event series that includes a collaborative Innovation Showcase event (Brace for Impact), a panel event focused on intellectual property in agri-food, and, finally, a collaborative Gryphon's LAAIR competition that is open to non-UofG entities. RIO staff are establishing the next steps in developing an execution plan for the 2022/23 events. In the future, RIO will be conducting a thorough analysis, in collaboration with the Alliance, to develop new and improved hybrid events to strengthen industry-academia relationships which will make the Ontario agri-food sector more competitive.

Table 3.22 provides the status of each of the activities related to the Gryphon's LAAIR identified in the 2021/22 Business Plan, as well as provides an update on any incomplete items from the 2020/21 Business Plan.

Table 3.22: Status Update on Business Plan Activities – Gryphon's LAAIR

Business Plan Activity	Status
Continue to use RMS for managing the Gryphon's LAAIR projects	Complete. RMS is working effectively to manage Gryphon's LAAIR projects.
Host another successful Impact Pitch Event, which most likely will be online with the potential for small viewing parties (obviously COVID-19 dependent)	Complete. The Gryphon's LAAIR Innovation Showcase and Pitch event was delivered but engagement was below expectations. RIO has submitted a proposal to RIB with a plan for an event series to be hosted in 2022/23.
Re-evaluate the Gryphon's LAAIR program in Summer 2021 and adjust if required, to mitigate any new constraints created by the COVID-19 pandemic	Complete. The Gryphon's LAAIR program is working effectively. The approach of providing financial support at two strategic stages of technology maturity continues to successfully move new research and technologies into the hands of industry.
Evaluate the fit of the three program aspects (Showcase, Pitch, Grants) to maintain the effectiveness of funds to generate commercial impact	In progress. The Pitch event requires improvement and planning which will continue into 2022/23, before a new event is executed.
Seek feedback from faculty applicants on the value and desire of the Gryphon's LAAIR program within the academic context	Complete. Faculty remain positive on the criteria and execution of the Gryphon's LAAIR program.
Continue collaborations with University of Guelph's Food from Thought Initiative, to amplify and leverage the Alliance's support for the commercialization of research in Ontario and Canada	On hold. This will be reassessed in 2022/23. During 2021/22, Food from Thought identified a greater need to support the growing number of Knowledge Mobilization (KMb) projects. Consequently, the Food from Thought Commercialization grants were not awarded, and funds were used to support KMb projects instead.
Continue to build relationships between academic entrepreneurs and investors interested in commercializing research in the agri-food sector	Ongoing. Through RIO's incubator, UofG entrepreneurs were assisted with introductions and partnership opportunities to enable their start-ups to grow and remain viable, as they developed their first products.

3.1.7 Knowledge Translation and Transfer Program

The Knowledge Translation and Transfer (KTT) program and Agri-Food and Rural Link (AFRL) are complementary programs designed to enable, enhance, and communicate the impact of Alliance research.

In 2021/22, Office of Research Agri-Food Partnership staff continued to collaborate with OMAFRA partners to digitally deliver KTT products and services to foster engagement and increase access to resources during the COVID-19 pandemic. Near the end of the fiscal year, select in-person programming commenced as the UofG began to transition to in-person delivery. For example, in March, the Office of Research began to welcome visitors back to the Agri-Food Research Centres at Elora with the support of the Research Centre Outreach Coordinator.

In 2021/22, the KTT and AFRL programs delivered targeted activities to advance the programs' objectives and support Ontario's agri-food and rural sectors. Below is a description of 2021/22 activities and achievements organized by objectives, as detailed in the OMAFRA-UofG Agreement.

Objective 1: Explore the science of KTT and provide end-user focused services and advice on best practices designed to create positive impact for research and innovation.

Core to this objective is the delivery of a flexible, nimble KTT Funding program to support researchers in creating additional impact from their completed research and advancing the science of KTT through research.

Six new KTT projects, totaling $283,900, were awarded for 2021/22, with two projects in the research stream and four in the mobilization stream. Project titles and award amounts are shown in Tables 3.23 and 3.24.

In addition, one project was funded under the KTT Initiatives program, which provides financial support of up to $5,000 for a product that translates and transfers research that benefits Ontario's agri-food sector or rural communities. The KTT Initiatives project is listed in Table 3.25.

Table 3.23: 2021/22 KTT Projects – Research

Lead Applicant	Project Title	Amount Awarded
Ataharul Chowdhury	Enabling adoption of digital technologies by Ontario rainbow trout farms	$67,900
Charlotte Winder	Improving biosecurity on Ontario dairy farms: exploring barriers to current KTT delivery and how to best address these	$61,500
Total - Research		**$129,400**

Table 3.24: 2021/22 KTT Projects – Mobilization

Lead Applicant	Project Title	Amount Awarded
Laura Van Eerd	Research case studies as learning enrichment tools for better soil management	$40,000
David Kelton	Case-based peer learning to support Ontario dairy producers improve dairy cattle welfare	$40,000
Ryan Gibson	Rural futures: mobilizing knowledge and sustaining partnerships	$35,000
Jennifer Ellis	360 degree KTT	$39,500
Total - Mobilization		**$154,500**

Table 3.25: 2021/22 KTT Initiatives Project

Lead Applicant	Project Title	Amount Awarded
Ernesto Guzman	Honey bee research centre - educational beekeeping videos and online outreach	$5,000
Total - Initiatives		**$5,000**

In addition to the KTT Projects that began in 2021/22, the UofG also undertook the annual call for applications to seek proposals for projects that will begin in 2022/23. The cycle began with a call for proposals in September 2021, with a due date of November 30, 2021.

Ten proposals were submitted with a total ask of $833,324. Based on committee review, five proposals were recommended for funding and will be detailed in next year's Consolidated Annual Report.

While the change to the budget envelope and project duration for KTT-R projects attracted larger, more sophisticated projects, many did not fall within the scope of the KTT Funding Program. In 2022/23, UofG will

continue to implement new processes and practices to help increase awareness of the KTT Funding Program and clarify the scope and purpose of the KTT Research Program.

Objective 2: Drive knowledge into action by advancing the synthesis, exchange, application and dissemination of knowledge resulting from Agreement-funded research.

Core to this objective is providing advice, training, and opportunities for skills development among UofG researchers, graduate students, and members of the wider agri-food and rural community in Guelph-Wellington. The following targeted activities were designed and deployed in 2021/22 to help partners and interested parties improve on the skills and networks necessary to enhance research impact.

Knowledge Exchange Events

Pathways to Commercialization (May 4, 2021): Delivered in partnership with OMAFRA, this event profiled innovative technology and commercialization activities funded through the Gryphon's LAAIR Program. This event was reported on in the 2020/21 Consolidated Annual Report since the bulk of the work was completed during 2020/21. Please refer to the 2020/21 Consolidated Annual Report for further details of the event.

Harvesting Data at Ontario's Agri-Food Research Centres Webinar (June 8, 2021): The Ontario Agri-Food Innovation Alliance is committed to increasing access and sharing of data to facilitate new agri-food and rural research and data analytics to inform decision-making. Part of this commitment includes the development of the Research Centre Data Access Portal at the Ontario Dairy Research Centre, Ontario Beef Research Centre, and the Precision Feed Facility.

This webinar was a discussion on harvesting data at Ontario's Agri-Food Research Centres and harnessing this data to advance research in the agri-food sector. The presentations and panel focused on the new Research Centre Data Access Portal in Elora and how data is being used to inform dairy and beef research. There were 223 individuals that attended the event (96 attendees from the UofG, 84 attendees from OMAFRA, 28 industry partners and 15 other).

The purpose of the webinar was to: 1) demonstrate how the Alliance is committed to increasing access and sharing of data to facilitate new agri-food and rural research and data analytics to inform decision making; 2) share information about the new Research Centre Data Access Portal at the Elora Research Station and discuss how new data resources are being used to inform and advance dairy and beef research; 3) highlight how the data portal is the first step to harvesting the data generated on 'smart farms'; and 4) share information about data harmonization and the meta-data generation and validation plan.

The event increased awareness of the Research Centre Data Access Portal among key audiences, including OMAFRA staff, industry partners, and the UofG community. In addition, it demonstrated to attendees how the funding through the Alliance is enhancing data capture at the Research Centres and leveraging UofG research expertise to help enhance the sharing and reuse of research data. Finally, it engaged the Minister's Office (MO), which requested a summary of event and additional information on the portal. This information was provided to Research and Innovation Branch personnel and subsequently briefed to the MO.

The recording is available on the Alliance YouTube channel and additional information on the event is available on the UofG Platform Supports More Robust Agri-Food Research webpage.

Mobilizing Knowledge in Ontario's Agri-Food Sector and Rural Communities (November 22, 2021): The University of Guelph and OMAFRA co-hosted a 2.5 hour 'Knowledge Exchange Event' to build capacity around knowledge mobilization tools and strategies that help achieve a positive impact in Ontario's agri-food sector and rural communities, and profile Alliance-funded Knowledge Translation and Transfer Mobilization and Mobilization Initiative projects.

The purpose of this event was to: 1) promote KTT methods and best practices; 2) increase awareness of ongoing Alliance-funded projects; and 3) maintain and enhance collaborations among UofG researchers and industry/government partners.

This event featured keynote speaker Andrew Campbell, Fresh Air Media, who discussed how to ensure knowledge translation is both effective and engaging in the agri-food sector. Following Andrew's talk were six presentations from UofG researchers who received funding from the KTT Mobilization and Mobilization Initiatives funding programs.

In total there were 246 attendees (109 attendees from OMAFRA/ARIO, 53 from UofG, seven from Agriculture and Agri-Food Canada, 38 from industry, 19 from other universities and 20 others). Of those who responded to the survey (N=18), 89% found the event informative, 72% found the event useful, and 83% found the event thought provoking.

At the conclusion of the event, UofG staff worked to expand the reach of material presented. The event recording was split into seven videos and posted on the Alliance's YouTube page for easy viewing. Three of these videos were shared on social media for additional promotion, garnering 1,835 impressions. In addition, the videos were viewed 69 times, enhancing the reach of the event. Additionally, these resources will be used to promote the KTT Funding Program during the 2022/23 cycle to help demonstrate the variety of projects supported by the program.

The link to the recording can be accessed via the Mobilizing Knowledge in Ontario's Agri-Food Sector and Rural Communities webpage on the Alliance website.

2022 Rural Symposium (February 10, 2022): The Rural Symposium, hosted by the School of Environmental Design and Rural Development, UofG, in partnership with OMAFRA and the Alliance, is an annual event intended to provide an opportunity for UofG graduate students to showcase their research, which focuses on rural development, to policy makers, analysts and program staff from OMAFRA. The symposium provides a unique opportunity for knowledge mobilization, allowing OMAFRA staff to increase their awareness of new and innovative research happening at the UofG, and fostering networking/relationship building for UofG graduate students, researchers, and OMAFRA staff. This year's event was hosted online, and profiled student research related to rural Ontario.

The planning and execution of the 2022 Rural Symposium was supported by staff from both the Alliance and OMAFRA. Staff from the Alliance's Knowledge Mobilization (KMb) team supported by participating in the planning committee as well as providing other administrative help including event promotion and Zoom facilitation.

The event featured welcoming remarks from Ontario Agricultural College (OAC) Dean, Rene Van Acker and Assistant Professor – Rural Planning and Development, Sara Epp, who touched on the importance of research related to rural Ontario and the benefit of the symposium for fostering relationship development and increasing awareness of critical research conducted at the UofG.

Throughout the day attendees viewed presentations from 19 graduate students (six poster presentations, 13 formal presentations) on work related to rural Ontario. In total, there were 226 attendees (93 attendees from OMAFRA, 94 attendees from UofG, and 39 others).

In the post event survey, which was completed by 24 participants, 23 out of 24 respondents indicated they felt the symposium was informative and thought-provoking, 20 out of 24 felt it was engaging, and 22 out of 24 felt the event was very useful. The poster and oral presentations are available on the Rural Review webpage on the University of Guelph Library website.

Objective 3: Evaluate and use KTT methods and best practices to support awareness and impact of research among end users.

A two-pronged approach is employed to address this key objective: deploy targeted communications activities to increase awareness of the Alliance and its research among key audiences; and evaluate and promote KTT best practices to help researchers enhance the impact of their Alliance-funded research.

Agri-Food Yearbook

The Agri-Food Yearbook was released in July 2021. The 2020/21 edition was a 32-page publication that profiled outcomes of Alliance-funded research and programming. With a focus on investing in innovation for real-world returns, this edition featured research during the COVID-19 pandemic, demonstrating how the Alliance and UofG researchers were nimble and pivoted quickly to continue delivering research and programming that helps the agri-food sector be resilient and recover from unexpected disruptions. The print publication was sent to approximately 24,000 producers across Ontario via Ontario Farmer and distributed to key partners across the UofG, OMAFRA and wider agri-food sector. In addition to the print publication, Office of Research Agri-Food Partnership staff delivered a comprehensive digital communications plan to extend the reach of Agri-Food Yearbook stories, thus increasing dissemination of ongoing research and research findings while expanding awareness of how the Alliance delivers *Ontario Solutions with Global Impact*. The digital promotion strategy included the following:

- Promotion of the 2020/21 Agri-Food Yearbook PDF on the Alliance and Office of Research websites. The PDF was downloaded 213 times from the Alliance website during 2021/22.
- Digitizing all 23 stories to the Alliance website and working collaboratively with the Office of Research to share each story on social media. The social media campaign ran from July to December 2021 between the Alliance Twitter and LinkedIn accounts, as well as the Office of Research Twitter (4,166 followers) and Instagram (1,649 followers) accounts. On the Alliance Twitter channel, the social media campaign generated 24,811 impressions, 409 engagements and 81 link clicks.

The Alliance continues to advocate for a digital first approach for the Yearbook and provided three updates to the Yearbook Strategic Review proposal during 2021/22.

Research Impact Case Studies

The Agreement requires that UofG complete a qualitative assessment and accompanying narrative to illustrate the longer-term cumulative impact of research and KTT activities on the end-user audience. This new reporting requirement resulted in the creation of three 100+ page reports detailing—based on quantitative research, interviews, and literature reviews—the long-term impact of the Alliance research program. In 2021/22, the UofG transformed the communications summaries of these impact case studies into engaging online assets to increase awareness of research findings and how funding through the Alliance research program delivers *Ontario Solutions with Global Impact*. The series is available digitally via a Microsoft Sway webpage dedicated to each theme, Research Impact Case Study: Dairy, Research Impact Case Study: Breeding & Genetics, and Research Impact Case Study: Innovation, as well as via fully accessible PDFs in the Case Studies section of the Alliance website. Print versions are also available by request. On September 17, 2021, the Alliance Executive Committee acknowledged the completion of the ICS requirements for the 2018 OMAFRA-UofG Agreement.

On January 13, 2022, the series was launched in the Alliance's monthly newsletter and on social media with a call to action to visit the websites. Analytics for the Alliance website indicate that 302 users visited the Alliance website on January 13, resulting in the highest number of daily users for the 2021/22 year. The campaign also ran on social media (Twitter and LinkedIn) for 13 days resulting in 13,149 impressions (number of times a post was viewed), 291 engagements (number of times a user interacted with the post), and 62 link clicks. In

addition, the Research Impact Case Studies were viewed a total of 1,562 times on Sway and downloaded 150 times.

Table 3.26 highlights key metrics for each webpage and PDF downloads.

Table 3.26: Metrics for Research Impact Case Study Series Webpages and PDFs

Metric	Dairy	Breeding & Genetics	Innovation
Total Views	607	393	562
Glanced Views	476	312	453
Quick Read Views	89	47	89
Deep Read Views	42	34	20
PDF Downloads	57	52	41

Promoting KTT Best Practices

The KTT program continued to support a series of resources and training opportunities to develop and promote best practices in KTT.

Online Resources: The Office of Research, collaborated with OMAFRA, to deliver a host of resources that help researchers develop and deliver high quality KTT plans, including sample KTT plans, summary of best KTT practices in agri-food and rural research, KTT case studies, a KTT appraisal tool, and a KTT manual. All of these products (available on the Alliance website's KTT Services and Resource webpage) are designed to support both researchers and reviewers in designing and assessing KTT plans to help ensure research is making the best use of public funds and is getting to the next user.

In 2021/22, engagement with KTT resources increased over 2020/21, based on number of website visits and downloads. In total, KTT resources were downloaded 452 times in 2021/22 compared to 314 times in 2020/21. In addition, pageviews of the KTT Services and Resources webpage increased by 40% relative to 2020/21, and the average time on the page increased by 13% to 2:04 minutes.

Metrics tell an important story about awareness and engagement with KTT materials. These resources are important tools to help support researchers and students think about meaningful engagement throughout the research process and get research into the hands of the next user.

In addition to online tools and resources, the Office of Research Agri-Food Partnership co-delivers an open, free KTT skills training series to increase access to KTT resources and best practices.

KTT Skills Series: From September 2021 to March 2022, the Office of Research Agri-Food Partnership partnered with RIO, and the Community Engaged Scholarship Institute (CESI) to deliver for the third year of the Skills for Research Impact workshop series. This series was offered in both the fall and winter semesters to faculty, research staff, and graduate students to enhance their skills related to designing and delivering KTT plans and, ultimately, enhancing the impact of their research.

In 2021/22, the Skills Series sessions had a total enrollment of 577. Sessions were delivered using Microsoft Teams on the following topics: planning for research impact; stakeholder engagement; clear language writing; KMb strategies and dissemination; evaluating KMb activities; digital storytelling for research communication; science-policy engagement; infographic design and development. Guest speakers included Dr. Anne Bergen from Knowledge to Action Consulting who presented on evaluation strategies, and Dr. Jeff Kinder, Director, Innovation Lab Institute on Governance who presented on strategies for science-policy engagement.

In 2021/22, Office of Research Agri-Food Partnership staff worked with OMAFRA's Agriculture Development Branch to increase OMAFRA access to the KTT Skills Series and deliver training targeted to OMAFRA's needs.

OMAFRA identified a need for training on creating infographics, so a strategic approach was taken to promote the existing infographic session to OMAFRA staff. In total, 27 staff registered for the infographic training session. UofG will continue to work with OMAFRA to identify KTT training needs and opportunities to expand the scope of the Skills for Research Impact Series.

Update on Business Plan Activities

Table 3.27 provides the status of each of the activities related to the KTT Program identified in the 2021/22 Business Plan, as well as provides an update on any incomplete items from the 2020/21 Business Plan.

Table 3.27: Status Update on Business Plan Activities – KTT Program

Business Plan Activity	Status
Administering the fourth KTT Funding Call (KTT Research and KTT Mobilization streams) under the new Agreement, expected to be launched in October 2021	Complete. The cycle began with a call for proposals in September 2021, with a due date of November 30, 2021. This call for proposals was the first to feature updated award values and project durations for the KTT Funding Program. Proposals in the KTT Research stream could be for projects of up to three years in duration with a total budget of $150,000, while the KTT Mobilization stream was modified to expand the scope of eligible projects. To promote the call and the updates to the structure of the KTT Funding Program, UofG staff leveraged Alliance communications channels and direct outreach to researchers.
Continuing to promote the KTT Funding Program using a combination of online and in-person advertisements and information sessions	Complete. As part of the communications campaign to promote the funding program, tweets issued to promote the funding opportunity received 2,595 impressions, 137 engagements and the Alliance webpage with KTT Funding Program information was viewed 577 times during the application period. The funding program was also featured in the Alliance newsletter, *Alliance Innovations* (see Section 1.6.2 for details on the newsletter and audience), promoted at the event 'Mobilizing Knowledge in Ontario's Agri-Food Sector and Rural Communities', and featured on the Alliance's LinkedIn page. A Townhall was held in October for interested researchers, graduate students, and support staff. In addition to leveraging the Alliance's communication channels, there was also a direct marketing campaign. Dr. Alison Duncan sent emails to all past and current recipients of the KTT Funding Program to advise them of program updates. The Office of Research Agri-Food Partnership Knowledge Mobilization Manager engaged College Research Managers, Graduate Program Assistants, the UofG One Health Institute, and Soils at Guelph to promote the funding program, and asked that they share the funding opportunity within their networks. Additionally, program information was shared by Food from Thought, RIO, and the Arrell Food Institute.
Continuing to administer KTT Initiative Grants (small grants less than $5,000) to support the	Complete. One project was funded in 2021/22.

Business Plan Activity	Status
development of products or events to disseminate research findings to users	
Promoting the KTT Initiative Grants using a combination of online and in-person advertisements and information sessions	Complete. See above for more details.
Supporting and/or leading delivery of two information exchange events to promote KTT methods, increase awareness of ongoing projects, and maintain and enhance collaborations among UofG researchers and industry / government partners	Complete. In addition to the events detailed above, UofG staff supported the delivery of the OMAFRA-led event 'Addressing Complex Problems in Agriculture and the Environment' (May 18, 2022). Of the six presenters, five were UofG researchers.
In collaboration with UofG campus partners, delivering KTT skills workshops targeting UofG agri-food researchers and/or graduate students to build KTT awareness and capacity in the research community	Complete. See above for more details.
Providing one-on-one consultations with UofG researchers with the goal of supporting development of high-quality KTT plans in Research Projects	Complete. One-on-one consultations were available to UofG faculty and staff to support development of their Alliance KTT plan. Uptake of these consultations continues to be low. Office of Research Agri-Food Partnership staff will continue to refine KTT resources and supports in 2022/23.
Promoting existing KTT tools, and update/develop new resources and/or services as needed (based on evaluation of existing KTT resources)	Complete. See above for more details.
Profiling and promoting research outcomes using the Alliance website, Twitter, and LinkedIn	Complete. See above and Section 1.6.1 and 1.6.5 for details.
Developing an annual workplan to support outreach related to the Ontario Agri-Food Research Centres	Complete. Outreach related to Ontario's Agri-Food Research Centres was impacted by the COVID-19 pandemic again during 2021/22. The Research Centre Outreach Coordinator position was re-filled in March 2022 and tours resumed in late March. Between March 21and April 30, 2022, UofG welcomed 55 tour attendees to the Research Centres at Elora. Additional promotion of the Research Centres was completed with design and distribution of the Research Impact Case Studies, which took place in Winter 2021.
Identifying opportunities to support faculty in the development of specific knowledge translation and	In progress. The Office of Research is in the process of assessing its current services to support researchers and will continue to look for opportunities to enhance service delivery in 2022/23.

Business Plan Activity	Status
transfer products or services to enhance the impact of Alliance-funded research	
Profiling and promoting findings of complete KTT research projects to advance the science of KTT in the agri-food and rural sector	Complete. The KTT event 'Mobilizing Knowledge in Ontario's Agri-Food Sector and Rural Communities' featured researchers with projects supported by the KTT Funding Program. Additionally, KTT resources (developed based on best practices identified through the research program) continued to be promoted and used by researchers to complete their KTT plans.
Producing two to three KTT products designed to enhance dissemination of aggregated research findings to target audiences	Complete. Engaging resources summarizing the Research Impact Case Study Series were designed and deployed in 2021/22 and are available online via the Alliance Case Studies webpage.
Enable application and reporting for KTT Initiative Grants to occur online in RMS	In progress. The KTT Initiatives proposal and report template are available in RMS. The workflows for report review, as well as for claims still need to be developed. The UofG anticipates that proposals will be submitted via RMS starting in August 2022. Once the system is fully enabled, the University will ensure that the core data from previous KTT Initiatives projects is entered for completeness.
Deliver online repository of project summaries in collaboration with the University of Guelph Library	In progress. UofG continues to work toward development of the metadata database using the Agri-Environmental Data Repository. In 2021/22, a pilot project was completed. More details can be found in Section 3.1.9.1.

3.1.8 Indirect Costs

Indirect costs are funds provided for the centralized research program support services of the University, including finance and human resources functions, along with campus physical plant infrastructure, information technology/systems, information resources/library, etc. necessary for the University to fulfil its obligations under the Agreement.

In 2021/22, the University commissioned an external consultant to complete a report on the actual costs to deliver the OMAFRA-UofG Agreement. The full cost was calculated at $19.3M (not including the incremental costs of faculty beyond the faculty pool amount). The Agreement provides $9.8M towards this cost, leaving a shortfall of $9.4M. This demonstrates that the University of Guelph essentially matches OMAFRA's contribution to the full cost of delivering the Agreement programs. In addition, these costs continue to increase year over year with inflationary pressure, which expands the University's contributions.

Table 3.28 provides the status of each of the activities identified in the 2021/22 Business Plan.

Table 3.28: Status Update on Business Plan Activities – Indirect Costs

Business Plan Activity	Status
Disseminating the results of the "full-cost" of research study performed by the University to OMAFRA	In progress. The external consultant completed an analysis of the "full cost" of research related specifically to the OMAFRA-UofG Agreement in Winter 2022. The University will share select data from this report with OMAFRA during the re-negotiation process.

3.1.9 Data Initiatives

FAIR data principles denote a commitment to making data findable, accessible, interoperable, and reusable. For organizations working towards FAIR data, this is an iterative, long-term commitment that requires the development of new administrative systems, technology, as well as education, incentives, and access to appropriate tools for data generators and users.

UofG is continuing its work toward enhancing the integrity, organization and access of data generated at Ontario's Agri-Food Research Centres – thus enhancing FAIR principles – beginning with a focus on the research centres based at the Elora Research Station (Ontario Dairy Research Centre, Ontario Beef Research Centre, and Ontario Crops Research Centre).

During 2021/22, the UofG added new, critical expertise to advance the agri-food data portfolio. In April, Dr. Michelle Edwards joined the Office of Research as the inaugural Director of Agri-Food Data Strategy. The new director role expands on the former position of Director, Data Strategy for the Food from Thought program, and is part of the University's long-term commitment to foster agri-food data excellence. The position will work to create systems and tools to harness data from two foundational funding programs - Food from Thought and the Ontario Agri-Food Innovation Alliance. More information about the new Director of Agri-Food Data Strategy can be found on the Alliance's news webpage, New UofG director to bring University-wide strategy for agri-food research data management news release.

3.1.9.1 Data Programming and Services

The University continues to deliver data programming and training services to enhance data stewardship, capacity, and documentation.

Data Management Plans

Data Management Plans (DMPs) are an important tool to help enhance data stewardship and to support the goal of improving the sharing and reuse of research data. Under the Agreement, DMPs are required for all Research Projects. The DMPs detail how data acquired during the research project will be stored, shared, and maintained. More information about DMPs for current Alliance Research Projects can be found in Section 3.2.2.3.

Metadata Database

OMAFRA funds the UofG to conduct essential agri-food research, which includes the collection of large amounts of data that can benefit and improve the agri-food sector in Ontario. Effective use and reuse of data are essential components of good data management, and the University is obligated to make the results of research projects funded under the 2018 OMAFRA–UofG Agreement publicly available.

To increase access and sharing of Agreement-funded research, the Alliance, in collaboration with the UofG Library, piloted the development and implementation of a project records or metadata database. This database will make project-level metadata from Alliance-funded research publicly available (where legally, ethically, and commercially possible) and ultimately aims to facilitate new agri-food and rural research and data analytics to inform decision making (Agreement Outcome 1.3 (f)).

The Agri-Environmental Research Data Repository was determined to be the suitable database to hold the project records. The pilot began in Spring 2021 and involved:

- Establishing which project record fields would be collected and mapped from the Research Management System, including fields from applications and final reports, as well as fields from data management plans (DMPs) developed using the Portage Network's DMP Assistant;
- Building a "bulk ingest" template for the Alliance to use to record metadata information and a guide for filling out the template;
- Developing a coding script to convert and integrate the records from Portage with those from RMS, ultimately making them compatible with the Agri-Environmental Research Data Repository; and
- Establishing and testing a workflow that informed the procedure "quick guide" that describes the process for entering Alliance project-level metadata into the Agri-Environmental Research Data Repository.

The pilot was completed in Winter 2022 with the successful upload of project records from two Tier I projects. The pilot raised opportunities to:

- Better communicate ownership and data governance policies to researchers;
- Identify which Creative Commons license will be assigned to the project record to help clarify metadata licensing;
- Identify strategies for updating records during the lifecycle of the project;
- Assess skills and capacity required to fully implement the upload of project records to the Agri-Environmental Research Data Repository;
- Develop a quality control process to ensure that all data are entered in a consistent manner;
- Address issues with accessibility of appended data (e.g., data sets, reports) to meet AODA requirements; and
- Investigate the strengths and weaknesses of using a manual upload versus an automated upload process.

In 2022/23, the Alliance intends to move this project into a second phase, where the learnings from the first pilot project will be used to scale-up data ingest and the processes to operationalize the database.

Table 3.29 provides the status of each of the activities related to Data Programming and Services identified in the 2021/22 Business Plan, as well as provides an update on any incomplete items from the 2020/21 Business Plan.

Table 3.29: Status Update on Business Plan Activities – Data Programming and Services

Business Plan Activity	Status
Continuing to deliver data management training sessions in collaboration with the University of Guelph's Library to support researcher capacity in data management	Complete. The University of Guelph Library delivered nine DMP-focused training sessions involving 168 participants in 2021/22, with one session targeted at UofG researchers with Ontario Agri-Food Innovation Alliance funding.

Business Plan Activity	Status
	In addition, the Alliance website continued to promote the availability of one-on-one consultations with a UofG Librarian to get assistance with completing their DMP. Wayne Johnston, Research and Scholarship Librarian, provided nine one-on-one consultations and reviewed 144 DMPs for Alliance-funded researchers in 2021/22.
Updating data management resources and process based on the findings of the joint Office of Research/UofG Library evaluation of data management plan (DMP) deployment and resources	Complete. The Office of Research continued to update and refine the resources available to UofG researchers seeking support completing their DMP. The updates made to the DMP template deliver higher quality, more comprehensive DMPs according to UofG Library review. Additional updates were made to the template and prompting language in March 2022 to better communicate OMAFRA's data access rights and the researcher's obligations when receiving Alliance funding; this resulted in a unique DMP template being created for the Alliance (the previous template was shared by researchers receiving funding from Food for Thought). In addition to template updates, the existing DMP resources continued to be used by researchers to complete their DMPs: The DMP page on the Alliance website received 814 page views in 2021/22. The video tutorial on completing a DMP was viewed 36 times for a total watch time of three hours. The DMP manual was downloaded 64 times and the sample DMP plans were downloaded 58 times.
Designing and deploying two data management information sessions for OMAFRA staff and leadership	In progress. Due to competing priorities, this task was delayed. Moving forward, the UofG will work with OMAFRA to identify the organization's interest and need for data management training sessions, as well as other relevant topics.
Ensuring full compliance on DMP submission, across all relevant programs	In progress. DMPs were made a condition of award beginning in the 2020/21 funding cycle. This ensures that no project moves forward without a Library-endorsed DMP. Prior to being made a condition of award, DMPs were a post-award requirement. The UofG is actively following up with researchers who have not yet submitted their DMPs. In addition, researchers, with outstanding DMPs, are prevented from accessing new Alliance funds until their DMPs are in place. The UofG expects to be fully compliant by the end of 2022.
Continuing implementation of a meta-data database for projects funded by the Ontario Agri-Food Innovation Alliance (i.e., projects funded since 2018)	In progress. The first phase of the project is complete. The second phase is expected to begin in 2022/23.

3.1.9.2 Research Centre Data Access Portal

The University continues to work on enhancing the capture, storage, and sharing of data generated at Ontario's Agri-Food Research Centres. The long-term objective of this project is to make the data generated at the Research Centres findable, accessible, interoperable, and reusable, and to align the data portal as a node of Agri-food Data Canada. The short-term objective remains to enhance data capture, consolidation, and access for researchers.

In 2021/22, data generated at the dairy and beef facilities continued to be made accessible to researchers via the Research Centre Data Access Portal.

During 2021/22, leadership of the portal was transitioned to Dr. Michelle Edwards. Dr. Rozita Dara will continue to support data governance and metadata development in her role as RPD.

In July 2021, Mr. Lucas Alcantara assumed the new role of Livestock Data Technician for the Research Centres. The technician role was designed to support integration and use of on-site technology at the livestock research centres, as well as the day-to-day management of the Research Centre Data Access Portal.

Since beginning in the role, Mr. Alcantara has made significant contributions to enhancing data stewardship and integrity at the Ontario Dairy Research Centre. He developed several real-time data dashboards used by centre staff to monitor data streams to ensure centre sensors and other technology are functional and reliably generating the data researchers rely on to advance their research projects. Two new servers have increased data capacity, integrity, and security. This new server capacity will also support the next iteration of the Research Centre Data Access Portal, as the UofG moves to advance the portal and make more high-quality data easily available to researchers.

Table 3.30 provides the status of each of the activities related to Research Centre Data Access Portal identified in the 2021/22 Business Plan, as well as provides an update on any incomplete items from the 2020/21 Business Plan.

Table 3.30: Status Update on Business Plan Activities - Research Centre Data Access Portal

Business Plan Activity	Status
Continuing to enhance the user interface and data organization for the data access portal	In progress. Work to refine the existing platform was paused while the search for the Director of Agri-Food Data Strategy was underway. Additional efforts to refine the user interface will be made as UofG continues to iterate the data access portal project.
Working to develop a metadata structure for the data portal to help facilitate data sharing and reuse	Complete. A project undertaken by Dr. Rozita Dara and Dr. Mitra Kaviani supported the creation of metadata describing select data points collected at the Ontario Dairy Research Centre. New metadata records included features such as data measurements, data units, and descriptive titles. This work will be incorporated in future iterations of the data access portal.
Developing a project plan to expand the Dairy and Beef portal to create an integrated, standardized data base for Ontario's Agri-Food Research Centres	In progress. Data from the Insentec feed bins at the Ontario Beef Research Centre were added to the portal. Additional work to standardize and integrate data will be delayed until the next iteration of the data access portal is developed.

Business Plan Activity	Status
Hiring and training the new Research Centre data technician	Complete. The second competitive hiring process was completed, and the position filled in July 2021 by Mr. Lucas Alcantara.
Developing, refining and implementing data governance policies and procedures to streamline researcher access to project-specific data and maintain data security	In progress. Existing governance policies and practices allow researchers to access project-specific data from both the dairy and beef research centres. The Livestock Data Technician now manages access to the portal per established procedures and has created new procedures to back-up data to ensure enhanced security. Data policies and procedures related to the portal will continue to be refined as the next iteration of the portal is explored.
Continuing to work closely with Agri-food Data Canada architects to identify opportunities for enhancement of data capture to support cross-University integration	Ongoing. The Director of Agri-Food Data Strategy role will be responsible for supporting agri-food initiatives across the UofG, including the Research Centre Data Access Portal and Agri-food Data Canada.

3.1.9.3 Improving the Utilization of Alliance Data to Benefit the Agri-Food Sector

The University is continuing to identify ways to improve the use and reuse of Alliance data to inform decision making for the benefit of the agri-food sector.

OAC Historical Research Data and Reproducibility Project

Dr. Michelle Edwards has been working to improve data access and storage for historical research projects completed by OAC researchers. Using papers published ten to twenty years ago—prior to widespread requirements to deposit data supporting research findings in a recognized repository—Edwards worked with and trained highly qualified personnel to clean and upload project data into the Agri-Environmental Data Repository for long-term preservation. Since the project was launched in 2020/21, Edwards and her team have uploaded datasets for 15 historical research papers, resulting in 266 files being added to the Agri-Environmental Data Repository. Files can be accessed by visiting the OAC Historical Research Data and Reproducibility Project page of the Agri-Environmental Data Repository on the Borealis website.

The Agri-Environmental Data Repository on the Borealis website was established in 2012 with support from the Alliance's KTT funding program. As detailed on the Library website, the purpose of the repository is to help facilitate sharing and long-term preservation and use of agricultural and environmental research data. Since it was launched in 2012, 161 datasets accounting for 3,305 files have been uploaded to the repository. Of the 161 entries, 98 are tagged as data sets specific to agricultural sciences, accounting for 1,241 files, with contributions from 100 researchers and staff.

The creation and continued use of the repository enhances data stewardship and demonstrates the sector's commitment to FAIR data principles in agri-food research. Additionally, with projects like the metadata database, the repository is being used to help improve FAIR principles in agri-food data.

3.2 Mandatory Compliance Requirements

3.2.1 Human Capacity

3.2.1.1 Research Faculty

Ontario needs a critical mass of world-class researchers to ensure its agri-food sectors and rural communities are poised to address current challenges and meet future opportunities. The Agreement contributes $11.145M for the research faculty pool which supports a minimum of 67.8 faculty full-time equivalent (faculty FTE) positions, with the expectation that at least that many FTEs will be engaged in Research Projects funded through the Agreement's Research Program. These projects respond directly to OMAFRA Priorities. The University's performance varies from year-to-year depending on the number and type of projects funded.

In 2021/22, the University of Guelph exceeded its target of delivering 67.8 faculty FTEs dedicated to Agreement-funded research by 15%. The 78.3 faculty FTEs is the cumulative effort of 247 faculty members in six Colleges leading and collaborating on Agreement-funded projects. This is slightly more than the 76.6 faculty FTEs reported in the 2020/21 Consolidated Annual Report.

Table 3.31 provides the total cumulative engagement of faculty in Research Projects, reported on at the College and Department level.

Table 3.31: 2021/22 Engagement of Faculty in Research Projects, reported by College and Department

College and Department	Faculty FTEs in Research Projects
College of Biological Science	**2.2**
Department of Human Health and Nutritional Sciences	0.8
Department of Integrative Biology	0.5
Department of Molecular and Cellular Biology	0.9
College of Engineering and Physical Sciences	**5.8**
Department of Physics	0.1
School of Computer Science	0.0
School of Engineering	5.6
College of Social and Applied Human Sciences	**2.0**
Department of Family Relations and Applied Nutrition	0.2
Department of Geography, Environment and Geomatics	1.2
Department of Sociology and Anthropology	0.5
Gordon S. Lang School of Business & Economics	**1.6**
Department of Management	0.3
Department of Marketing and Consumer Studies	1.1
School of Hospitality, Food and Tourism Management	0.3
Ontario Agricultural College	**49.8**
Department of Animal Biosciences	13.3
Department of Food Science	2.0
Department of Food, Agricultural and Resource Economics	3.4
Department of Plant Agriculture	11.6
Ridgetown Campus	8.2
School of Environmental Design and Rural Development	2.7

College and Department	Faculty FTEs in Research Projects
School of Environmental Sciences	8.7
Ontario Veterinary College	**16.9**
Department of Biomedical Sciences	1.8
Department of Clinical Studies	1.6
Department of Pathobiology	6.2
Department of Population Medicine	7.4
Total	**78.3**

Table 3.32 provides faculty FTEs in Research Projects over the term of the Agreement. The University has surpassed the target in each of the last four years.

Table 3.32: Faculty FTEs in Research Projects over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Faculty FTEs in Research Projects	77.7	75.5	76.6	**78.3**		67.8

3.2.1.2 Research Technicians

The Agreement also supports technical capacity which is critical to the success of the University in fulfilling the outcomes of the Research Program.

The University reports on the engagement of scientific and technical FTE allocations (non-faculty) against all Research Projects, as well as any additional technical support capacity in the Research Support program activity beyond the Research Projects (e.g., technical support assigned to a Research Centre).

In 2021/22, the University of Guelph exceeded its minimum target of 42.4 research technical FTEs. The total of 104.0 technical FTEs reported on is the cumulative effort of 185 people working on Agreement-funded research.

Table 3.33 provides the total cumulative engagement of research technician FTEs, reported on by program.

Table 3.33: 2021/22 Engagement of Research Technician FTEs by Program

Program	Research Technician FTEs
Tier I Research	40.7
Gryphons LAAIR	1.2
KTT Program	1.0
Special Initiatives	3.7
Tiers II and III Research	26.3
Other Technical Support (not Research Project specific)	31.1
Total	**104.0**

Table 3.34 provides research technician FTEs over the term of the Agreement. The University has exceeded the target in each of the last four years.

Table 3.34: Research Technician FTEs over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Research Technician FTEs	87.6	96.7	108.1	**104.0**		42.4

3.2.1.3 Research Support

The Agreement funds administrative support within the academic units who ensure the efficient and effective operation of the Research Program.

In 2021/22, the University of Guelph achieved the minimum target of 22.5 research support FTEs. Table 3.35 provides the total cumulative engagement of research support FTEs, reported on by type.

Table 3.35: 2021/22 Engagement of Research Support FTEs, by Type

Type	Research Support FTEs
Administrative Support	17.4
Ridgetown Campus Support	5.2
Total	**22.6**

Table 3.36 provides the Research Support FTEs over the term of the Agreement. The University has achieved the target in each of the last four years.

Table 3.36: Research Support FTEs over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Research Support FTEs	22.8	22.5	22.8	**22.6**		22.5

3.2.2 Research Project Requirements

The University confirms that it is working towards administering all Research Projects as per the research project requirements outlined in the Agreement.

3.2.2.1 Report Review

A new Report Review policy was approved by the joint OMAFRA-UofG Management group in 2021/22. Its purpose is to support the timely submission and review of annual and final research progress reports that appropriately balance information needs with the reporting expectations placed on lead applicants.

The first stage of the report review cycle is the submission of the report by the researcher. The hiring of the Manager, Research Program Compliance has had a substantial and continuing positive impact on reducing the number of overdue reports, thus increasing the number of reports ready for OMAFRA review.

There were 318 reports due between May 1, 2021 and April 30, 2022, a 28% increase over 2020/21. Of these, 40 remain outstanding to date, which is approximately 13%. While this is an increase over last year, it is still a significant improvement over the overdue rates experienced previously. The UofG is continuing to actively work with researchers to encourage timely reporting and following up vigorously when that is not the case.

At the end of 2021/22, there were 81 reports in the review cycle. This is a 28% decrease from the 113 reports in the review cycle at the end of 2020/21.

There were 189 reports approved in 2021/22. The average number of days from submission to approval was 159 days, with 44% of reports reviewed in 120 days or less. Eight percent of reports were reviewed in 56 days (the recommended time frame in the Report Review policy), which is significant decrease from the 24% that were meeting the target last year. The average number of days from submission to approval decreased by 34% over the 2020/21 value of 244 days, although only an 8% reduction from the 2019/20 review timeline of 172 days.

Currently, due to RMS limitations, it is not possible to identify the time spent at each stage of the review cycle for reports that have been approved. However, it is possible to illustrate the average number of days those reports have been at the current stage for reports currently in review. While this tends to overestimate the average time that a report spends in review, it provides useful information. In some stages of the process, reports can be held up for various compliance reasons (e.g., obtaining additional information from the researcher outside of a revision workflow) or while a project is being addressed in Issues Resolution, which lengthens the average number of days in the specific stage. In addition, the average number of days does not include reports that are approved quickly.

Table 3.37 shows the number of reports currently under review and the average number of days that they have spent at the current stage in the review cycle (as of June 13, 2022).

Table 3.37: Number and Stage of the Reports in the Review Cycle, as of June 13, 2022

Stage in the Review Cycle	Number of Reports	Average Number of Days in Current Stage	Target Number of Days in Each Stage
UofG Compliance Review	36	12.4	10
UofG Financial Review	18	6.9	4
OMAFRA IKM-RA Review	41	101.1	14
OMAFRA RPC-RA Review	39	122.8	14
UofG Program Sponsor Review and Decision	26	20.1	14
Revisions for UofG Review	9	33.0	
Total	**169**		**56**

While all stages are falling short of the targets, there are several significant bottlenecks in the review cycle, which are evident when considering the number of reports and the average number of days. Also, it is concerning that the average number of days in OMAFRA IKM-RA Review increased substantially from 32.0 in 2020/21 to 101.1 in 2021/22. Review times will need to be addressed by OMAFRA, as timely report review is critical for maintaining appropriate oversight on the research projects and providing useful feedback to researchers. In addition, as the UofG has worked extensively to improve compliance in terms of report submission, it is critical that the Alliance provide feedback in a timely fashion, as a matter of credibility. Delays in report review also impact the transfer of budgetary installments and the approval of amendments.

To begin to mitigate these delays, OMAFRA has been piloting a single stage review process for projects within a research priority area where one Research Analyst (RA) completes both the IKM-RA and RPC-RA review of the report. This has potential to substantially decrease review times should it be expanded to all priorities and projects. In addition, effective management of OMAFRA RMS staff assignments when staff move or take on new files is also important to ensure that report review assignments remain current. The UofG will continue working closely with RIB to address the roadblocks.

Finally, the UofG has posted a “Quick Tips: Preparing Your Report” document on the website that provides best practice information and addresses common feedback from the process. This will assist the researchers in submitting high-quality reports in the first instance, create efficiencies for the reviewers, limit the number of reports in the requires revisions status and ultimately, reduce the average number of days from report submission to approval.

3.2.2.2 Amendments

An Amendment policy document was developed and approved by the joint OMAFRA-UofG Management group in 2020/21. It identifies when an amendment or minor change request is required, and outlines the request, review, and project revision process. The University utilizes the amendment process to notify the Ministry of any timeline or other significant variance being requested and to receive the Ministry's consent prior to the University approving the variance.

In 2021/22, 91 amendments were submitted, which is down from 115 last year. Of the 91 amendments, 80 amendments have been approved, four are still under review, six have requests for further details from the researcher, and one was rejected. The average time to approval was 78 days, which is almost double last year's value of 40 days. To address this increase, the University will work with OMAFRA to ensure amendment review targets are adhered to. It will also be important to improve on the visibility and function of amendments in RMS to ensure all parties can address amendments in a timelier manner.

Table 3.38 shows the distribution of amendment requests by type, noting that more than one type can be selected on an amendment request. 95% of the amendment requests involved a project extension.

Table 3.38: Distribution of 2021/22 Amendment Requests by Type

Type of Amendment Request	Number of Amendment Requests
Project Extension	77
Project Extension and Change in Lead Applicant	1
Project Extension and Other	8
Other	5
Total	**91**

When selecting project extension as the type of amendment request, researchers were asked to identify the reason(s) (researchers have the option to identify more than one). Table 3.39 provides the distribution of the project extension requests by reason. In 2021/22, 79% of project extension requests listed COVID-19 as a reason, while 51% cited that the completion of milestones took longer than expected and 35% indicated that the extension was related to the timing of graduate student hiring.

Table 3.39: Distribution of 2021/22 Project Extension Requests by Reason

Reason for Extension	Frequency	Frequency as a Percentage of the Total Number of Extension Requests (N=86)
COVID-19	68	79%
Completion of milestones took longer than expected	44	51%
Timing of Grad student hiring	30	35%
Other	21	24%
Additional KTT to be completed	13	15%
Mid-project staff changes	9	10%
Timing of Research Centre access	5	6%
Changes to Lead Applicant availability	3	3%
Weather/growing season issues	1	1%

It is expected that the number of project extension requests will continue to fall, as the impacts of the COVID-19 pandemic subside.

3.2.2.3 Data Management Plans

The University is required to ensure that a Data Management Plan (DMP) is in place for each Research Project and that it is fully executed. To address some challenges attaining full compliance with the requirement, the University updated the DMP process in 2020/21 to require the completion of a library-endorsed DMP as a condition of award. This means that all new Research Projects that started in 2021/22, required a library-endorsed DMP prior to being awarded any funding, ensuring 100% compliance.

This system is made possible by the consistent, timely work of the UofG research and scholarship librarians who commit to a five-day turnaround upon receiving a draft DMP. While all DMPs have been returned within this window, the majority are returned to the researcher sooner, preventing any undue delay in finalizing project award agreements.

Prior to being made a condition of award, DMPs were a post-award requirement. Over 2021/22, the UofG research program team increased cross-program compliance for these earlier projects by nearly 30%. The current compliance rates by program are as follows:

- Tier I is 92% (47 out of 52 for 2018/19 projects, 47 out of 48 for 2019/20 projects, and 42 out of 48 for 2020/21 projects).
- Gryphon's LAAIR is 95% (8 out of 8 for 2018/19 projects, 7 out of 8 for 2019/20 projects, and 4 out of 4 for 2020/21 projects).
- KTT Research is 100%. KTT Mobilization projects do not require a DMP.
- Special Initiatives is 79% (1 out of 1 for 2018/19 projects, 7 out of 11 for 2019/20 projects and 11 out of 12 for 2020/21 projects).
- Tier II is 81% (8 out of 8 for 2018/19 projects, 15 out of 19 for 2019/20 projects, and 20 out of 26 for 2020/21 projects).

The UofG is actively following up with researchers who have not yet submitted their DMP and expects to be fully compliant by the end of 2022.

3.2.2.4 Issues Resolution

The Issues Resolution Policy was approved on November 3, 2021 by the joint OMAFRA-UofG Management group.

OMAFRA and the UofG held one specific joint Issues Resolution Meeting in 2021/22, as well as used other scheduled joint OMAFRA-UofG Management meetings, to address four projects for which unresolved issues had been identified. Consensus was achieved on the outcomes for each of the projects, which have been actioned by the University. An RMS enhancement to allow the acknowledgement of an annual or final report has been requested and is needed to fully resolve some projects that have come through the Issues Resolution process.

For each of the four projects, the root causes of the issues were determined. One was related to a faculty member leaving the University. Two others were related to interruptions due to COVID-19 and the ability for industry partners to deliver on project needs. The final project was related to an interpersonal issue with a co-applicant. In this case, aspects of the project's deliverables were incorporated into an existing Special Initiatives project, with OMAFRA's approval.

Table 3.40 briefly outlines the outcome, including the decision indicator, for each of the projects discussed.

Table 3.40: Outcome for the Projects Discussed at the 2021/22 Issues Resolution Meetings

Outcome and Decision Indicator	Tier I	Gryphon's LAAIR	Total
Terminate project. Did not meet expectations.	2	2	**4**
Total	**2**	**2**	**4**

3.2.2.5 Post-Project Verification

A risk-based approach has been developed to select and validate completed Research Projects for Post-Project Verification (PPV). The methodology includes verification of Research Faculty FTE effort and Agreement FTE effort, level of third-party funding, timelines, project objectives, execution of Data Management Plans and KTT Plans, and compliance with requirements of the Agreement.

This approach has been provided to OMAFRA RIB for their feedback and approval. It involves using an arm's length individual to perform the PPV assessment. Once the approach has been agreed to, the first PPV assessment will occur shortly thereafter, with the results shared with OMAFRA in Fall 2022.

3.2.3 USEL/HQP Projects

The University confirms that it is administering the USEL and HQP Projects as per the Ministry's reporting requirements as outlined in the Agreement. All necessary templates exist in RMS for USEL and HQP Projects. The majority of the processes and workflows have been developed, with the exception of the review workflow process for the USEL Projects. This is expected to be finalized in Fall 2022. All data from past USEL and HQP Projects, to the start of the current Agreement, has been entered into RMS.

3.2.4 Research Call Process

The University confirms that it has advised the Ministry at least ten Business Days in advance of the University's intent to launch a call for proposals and has administered the calls through a process determined by the Ministry, which includes Ministry approval of all successful proposals or applications where all or part of the proposals or applications will be funded in whole or in part using Research Funds.

3.2.5 Third-Party Funding for the HQP Scholarship Program

The University confirms that it secured third-party funding of $320K in 2021/22 to meet the objectives of the HQP Scholarship Program from Food from Thought – Agricultural Systems for a Healthy Planet program under the Canada First Research Excellence Fund (CFREF). This funding will flow as the scholarships to the award recipients are paid out. This exceeds the minimum funding required of $250K.

3.2.6 Research Project Administration

The University confirms that it is working towards administering all Research Projects listed within RMS consistent with Section C.11 of the Program Schedule. Continued issues in the implementation and improvement of RMS have impacted the University's ability to meet this requirement. However, with the implementation of the KTT Initiatives program in RMS, the University will be fully compliant. This is expected to be complete in Summer 2022.

3.2.7 Website

The University confirms that a public facing, up to date website for the Agreement exists at: https://www.uoguelph.ca/alliance/. A number of website updates occurred during 2021/22 to better serve the needs of the Agreement and tell the stories of its impact. Section 1.6.1 provides more details.

3.2.8 Capacity Strategy Plan Acknowledgement

The University maintains a Capacity Strategy Plan to ensure that the necessary faculty and staff resources are available to support the capacity needs of the Research Program. The University's strategy to address continued capacity in OMAFRA's priority areas, and to manage emerging issues, is congruent with its institutional goal of remaining the top-ranked agriculture and veterinary medicine university in Canada. The Colleges and the academic units therein have strategic plans that identify discipline priorities for faculty hiring, which map onto the demographics of the faculty. These College priorities reflect emerging issues in Ontario's agri-food sector, which also reflect Ministry priorities. In general, the University strives to be an employer of choice, demonstrated by their eleventh place finish among Canadian universities in the list of Canada's Best Employers by Forbes Magazine. The University offers competitive salary and start-up funding for new researchers and has made achieving equity and diversity throughout the ranks of employees a priority.

3.2.9 Resources to Administer the Research Program

The University confirms that the necessary resources, including faculty and support staff, are available to administer the Research Program. Dr. Beverley Hale continues to provide outstanding leadership in support of the governance structure as a R/PM PMC Co-Chair.

The Office of Research Agri-Food Partnership directly supports the Research Program. In 2021/22, the University maintained its full complement of staff to assist with the delivery of the Research Program, albeit working remotely due to the COVID-19 pandemic. There have been a few staffing changes over the year, however the Office is currently at full capacity and has the resources needed to effectively administer the Research Program.

3.2.10 Mitigation of Labour Dispute, Emergency or Force Majeure

The Agreement requires that the University take all necessary actions to mitigate the effects of a force majeure, labour dispute or emergency to ensure that it can continue to fulfil its obligations, covenants, and responsibilities to the greatest extent possible under this Program Schedule and the Agreement.

In 2021/22, the COVID-19 pandemic continued to provide an excellent example of a force majeure. The University was able to successfully mitigate most of the impacts of COVID-19 on the Research Program through the dedication of researchers and their teams, as well as the significant work of the Office of Research. The University demonstrated that it has the capacity and governance structures in place to manage issues at both the operational and strategic levels. While some specific Research Projects continued to experience delays, many projects were able to continue/complete successfully.

3.3 Key Performance Indicators

3.3.1 Faculty Engaged in Research Supportive of Ministry Priorities

The University leverages investments made through the Agreement to ensure Ontario has the intellectual capacity to support a sustainable, globally competitive agri-food sector, and vibrant rural communities.

In 2021/22, there were 148.6 faculty FTEs engaged in research supportive of Ministry priorities. This significantly exceeded the target of 97.0 research faculty FTEs. It involved 395 individuals (47.2% of all UofG faculty[19]) conducting research supportive of Ministry priorities. This was a slight decrease from the 149.6 faculty FTEs engaged in research supportive of Ministry priorities in 2020/21, but a 0.5% increase in the total number of faculty members engaged.

Table 3.41 provides a listing by college of the number and total FTEs of faculty engaged in research supportive of Ministry priorities.

Table 3.41: 2021/22 Faculty Engaged in Research Supportive of Ministry Priorities by College

College	Number of Faculty Members	Total FTEs Engaged in Research Supportive of Ministry Priorities
College of Arts	1	0.2
College of Biological Science	47	14.2
College of Engineering and Physical Sciences	55	14.2
College of Social and Applied Human Sciences	25	5.2
Gordon S. Lang School of Business & Economics	22	4.4
Ontario Agricultural College	173	82.8
Ontario Veterinary College	72	27.6
Total	**395**	**148.6**

Table 3.42 shows the FTEs engaged in research supportive of Ministry priorities over the term of the Agreement. The University has surpassed the target in each of the last four years.

Table 3.42: Research Faculty FTEs Engaged in Research Supportive of Ministry Priorities

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Faculty FTEs Engaged in Research Supportive of Ministry Priorities	153.0	152.1	149.6	**148.6**		97.0

[19] 836 Full-Time Faculty at the University of Guelph on October 1, 2021 as per the Office of Institutional Research and Planning (https://irp.uoguelph.ca/full-time-faculty-reports).

3.3.2 Highly Qualified Personnel

The Agreement delivers the future agri-food workforce through a variety of programs. This investment allows undergraduate students, graduate students, and postdoctoral fellows to contribute to Ontario's agri-food and rural sectors during their training while also building the future agri-food workforce. Table 3.43 below illustrates the number of Masters students, Doctoral students, and Post-Doctoral Fellows engaged in research projects by program and research priority. A target of 14 HQP per $1M invested has been set. In 2021/22, the University exceeded the target by 23% and reached 17.2 HQP per $1M invested for all in scope programs. This metric appears to be very stable over time.

The University has identified, from market analysis, that in 2017 there were currently four jobs in Ontario for every agri-food graduate[20] and there is no indication that current demand is any less than that. Overall, the number of graduate students across the University, with projects addressing Ministry priorities, is increasing. This growth reflects the University's added financial support for programs that demonstrate market need, as planned in the University's Strategic Mandate Agreement with the Government of Ontario.

Table 3.43: 2021/22 Number of Highly Qualified Personnel Engaged in Research Projects by Program and Research Priority

Program and Research Priority	Masters Students	Doctoral Students	Post-doctoral Fellows	Total	Agreement Investment	HQP per $1M Invested
Tier I Research	**55**	**25**	**28**	**108**	**$6,961,342**	**15.5**
Animal Health & Welfare	12	9	15	**36**	$2,048,686	**17.6**
Competitive Production Systems	14	4	5	**23**	$1,564,434	**14.7**
Innovative Products	3	2	2	**7**	$523,300	**13.4**
Plant Health & Protection	4	3	1	**8**	$742,060	**10.8**
Soil Health	4	1	1	**6**	$591,500	**10.1**
Strong Rural Communities	8	1	0	**9**	$330,804	**27.2**
Sustainable Production Systems	7	2	2	**11**	$575,400	**19.1**
Water Quality & Quantity	3	3	2	**8**	$585,158	**13.7**
Gryphon's LAAIR	2	7	4	**13**	$412,495	**31.5**
KTT	7	1	3	**11**	$285,400	**38.5**
Total–In Scope Programs	**64**	**33**	**35**	**132**	**$7,659,237**	**17.2**
Special Initiatives	1	0	0	**1**	$280,000	**N/A**
Tiers II and III Research	20	26	**12**	**58**	$0	**N/A**
Total–Out of Scope Programs	**21**	**26**	**12**	**59**	**$280,000**	**N/A**
Total-All Programs	**85**	**59**	**47**	**191**	**$7,939,237**	**N/A**

Table 3.44 shows number of HQP per $1M invested over the term of the Agreement. The University has exceeded the target in each of the last four years.

[20] "Planning for Tomorrow 2.0 Report," Ontario Agricultural College, University of Guelph, accessed July 21, 2022, https://www.uoguelph.ca/oac/about/planning-tomorrow-20-report

Table 3.44: Number of HQP per $1M Invested over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Number of HQP per $1M Invested	17.1	17.0	17.1	**17.2**		14.0

Table 3.45 provides the number of diploma and undergraduate students engaged in research projects by program and research priority for the 2021/22 research projects. There were 103 diploma and undergraduate students involved in research projects. This is down from previous years, likely due to the ongoing impacts of the COVID-19 pandemic which have made it slightly more difficult to include diploma and undergraduate students in research projects. With the lifting of the requirement for Research Management Plans, it is expected that diploma and undergraduate students will return to pre-pandemic levels.

Table 3.45: 2021/22 Number of Diploma and Undergraduate Students Engaged in Research Projects by Program and Research Priority

Program and Research Priority	Diploma / Undergraduate Students
Tier I Research	**69**
Animal Health & Welfare	17
Competitive Production Systems	16
Innovative Products	4
Plant Health & Protection	15
Soil Health	5
Strong Rural Communities	0
Sustainable Production Systems	7
Water Quality & Quantity	5
Gryphon's LAAIR	7
KTT	1
Total–In Scope Programs	**77**
Special Initiatives	0
Tiers II and III Research	26
Total–Out of Scope Programs	**26**
Total - All Programs	**103**

3.3.3 HQP Employment

The HQP Employment performance metric helps to assess the impact of the HQP Scholarship Program and the USEL Program in preparing students for future careers in government, academia, or industry upon graduation. It is the percentage of HQP Scholarship Program or USEL Program graduates employed by the agri-food sector or directly related industries or in rural economic development at post-program/post-graduation.

The survey is expected to be completed every three years (minimum) as per the frequency identified in the Agreement. The first survey of the HQP Scholarship Program participants occurred in 2019/20, while the first survey of USEL Program participants was completed in 2020/21. The second survey for HQP Scholarship Program and USEL Program participants will be completed jointly in 2022/23, with the results to be reported in the 2022/23 Consolidated Annual Report.

Table 3.46 shows the HQP employment metric over the term of the Agreement.

Table 3.46: HQP Employment Metric over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
HQP Employment in the Agri-Food or Rural Sectors	N/A	76% (HQP)	96% (USEL)	**N/A**		75%

3.3.4 Ratio and Value of Third-Party Funding and In-Kind Contributions

OMAFRA's investment in the Agreement's Research Program is leveraged through external third-party funding. This leverage enables a larger critical mass of resources to be directed to a specific line of enquiry, which speeds delivery of results in response to OMAFRA's Priorities. The leverage validates the importance of the research to stakeholders including industry, other government agencies, and civil society. Through the leveraging of relationships, KTT is more targeted and timelier. Finally, the leveraging partners often become engaged with the HQP that are part of the project, thus providing valuable training opportunities and relationship building.

In 2021/22, OMAFRA's $7.66M of research operating funding leveraged $7.12M of third-party contributions. Table 3.47 below illustrates the amount of cash and in-kind leverage, as well as the ratio, by program and research priority. A target ratio of 1:1 has been set. The University fell slightly short of the target with an overall ratio for in scope programs of 0.93:1. Tier I Research Projects faired slightly better with a ratio of 0.98:1. These leverage ratios were likely impacted by the COVID-19 pandemic. Co-funders for the 2021/22 calls were sought out in Fall 2020, at the height of the pandemic. Interactions and networking opportunities were limited, and many industries and small and medium enterprises (SMEs) were worried about survival-type issues rather than investments. If the impacts of the pandemic continue to wane, it is anticipated that this will improve for the 2022/23 call.

In addition, there continues to be significant differentials of leverage based on research priority, with some priorities attracting considerable leverage and others, such as those that deliver public policy or other 'greater public good', attracting very limited leverage. As more of those priorities or research questions are introduced, the opportunities for, and amount of, financial leverage become more limited, impacting the overall leverage ratio. For example, Strong Rural Communities was a new research priority introduced in the 2021/22 call which had a lower leverage capacity. Without that priority included, the leverage ratio would have been 1.02:1 for Tier I and 0.97:1 overall.

Table 3.47: 2021/22 Ratio and Value of Third-Party Funding and In-Kind Contributions for Research Projects

Program and Research Priority	Cash Leverage	In-Kind Leverage	Total Leverage	Agreement Investment	Leverage Ratio
Tier I Research	**$4,993,678**	**$1,808,572**	**$6,802,250**	**$6,961,342**	**0.98:1**
Animal Health & Welfare	$2,289,866	$632,349	**$2,922,215**	$2,048,686	**1.43:1**
Competitive Production Systems	$1,157,315	$607,500	**$1,764,815**	$1,564,434	**1.13:1**
Innovative Products	$66,000	$266,600	**$332,600**	$523,300	**0.64:1**
Plant Health & Protection	$664,500	$53,500	**$718,000**	$742,060	**0.97:1**
Soil Health	$143,657	$106,015	**$249,672**	$591,500	**0.42:1**
Strong Rural Communities	$15,000	$0	**$15,000**	$330,804	**0.05:1**
Sustainable Production Systems	$543,340	$64,608	**$607,948**	$575,400	**1.06:1**
Water Quality & Quantity	$114,000	$78,000	**$192,000**	$585,158	**0.33:1**
Gryphon's LAAIR	$51,000	$127,440	**$178,440**	$412,495	**0.43:1**
KTT	$46,800	$90,200	**$137,000**	$285,400	**0.48:1**
Total–In Scope Programs	**$5,091,478**	**$2,026,212**	**$7,117,690**	**$7,659,237**	**0.93:1**
Special Initiatives	$0	$0	**$0**	$280,000	**N/A**
Tiers II and III Research	$6,721,548	$201,432	**$6,922,980**	$0	**N/A**
Total–Out of Scope Programs	**$6,721,548**	**$201,432**	**$6,922,980**	**$280,000**	**N/A**
Total–All Programs	**$11,813,026**	**$2,227,644**	**$14,040,670**	**$7,939,237**	**N/A**

Table 3.48 provides the ratio of third-party funding and in-kind contributions for research projects over the term of the Agreement. The University was slightly short of target in 2021/22, after achieving it in 2020/21.

Table 3.48: Ratio of Third-Party Funding and In-Kind Contributions over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Ratio of Third- Party Funding and In-Kind Contributions	1.00:1	0.93:1	1.02:1	**0:93:1**		1.00:1

3.3.5 Total Third-Party Funding of University Research Supportive of Ministry Priorities but not funded by the Agreement

The University works hard to leverage the OMAFRA-UofG Agreement to grow agri-food research and innovation in Ontario.

In 2021/22, Agreement investments helped researchers attract another $61.9M in non-Agreement funding for research projects supportive of Ministry priorities. This leverage value involved 677 projects. This funding enhances Guelph's position as a nexus of agri-food innovation, where academia, government and industry come together to support the provincial, national, and international agri-food sectors, and rural communities.

Table 3.49 shows the value of non-Agreement funding for research supportive of Ministry priorities by type and college. With the Ministry's investment of $51.4M to support research, the leverage ratio for 2021/22 was 1.20:1. This exceeded the target ratio of 0.70:1 by 72%. This was also 12% higher than the 2020/21 value of 1.07:1.

Table 3.49: 2021/22 Value of Third-Party Funding for Research Supportive of Ministry Priorities by Type and College (in thousands of dollars)

College	Academic / Research	Business / Industry / NGOs	Govern-ment	Total Investment
College of Arts	$0	$0	$57	$57
College of Biological Science	$421	$2,932	$8,543	$11,896
College of Engineering and Physical Sciences	$33	$1,332	$3,380	$4,745
College of Social and Applied Human Sciences	$50	$946	$1,148	$2,144
Gordon S. Lang School of Business & Economics	$5	$864	$168	$1,037
Ontario Agricultural College	$409	$13,450	$10,863	$24,722
Ontario Veterinary College	$199	$1,343	$2,209	$3,751
University	$0	$0	$13,518	$13,518
Total	**$1,116**	**$20,868**	**$39,885**	**$61,869**
Agreement Investment in Research				**$51,428**
Leverage Ratio				**1:20:1**

Table 3.50 provides the ratio of third-party funding for research supportive of Ministry priorities to Agreement investment in research over the term of the Agreement. The University has surpassed the target in each of the last four years.

Table 3.50: Ratio of Third-Party Funding to Agreement Investment over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Ratio of Third-Party Funding for Research Supportive of Ministry Priorities to Agreement Investment	1.05:1	1.03:1	1.07:1	**1.20:1**		0.70:1

3.3.6 Number and Type of Third-Party Organizations Supporting Research Projects

Financial support comes from a variety of third-party organizations in the agri-food sector (co-funders). Their interest in the University's research demonstrates the value of the research outcomes to the sector.

Table 3.51 below illustrates the number and type of third-party organizations supporting research projects, by program and research priority. A target of 20.0 co-funders per $1M invested has been set. In 2021/22, the University fell 3% short of the target with 19.3 co-funders per $1M for all in scope programs, which was equivalent to approximately five additional co-funders. It is important to note that most of the financial partners are of the Business / Industry / NGOs type, which clearly indicates that the University is addressing the needs and economic prosperity of the agri-food sector.

The number of co-funder was also likely impacted by the COVID-19 pandemic. As mentioned in Section 3.3.4, co-funders for the 2021/22 calls were sought out in Fall 2020, at the height of the pandemic. Interactions and networking opportunities were limited, and many industries and SMEs were worried about survival rather than investment. These factors predominantly impacted smaller co-funders, which this metric favours. This is expected to improve for the 2022/23 call.

Also, like the observation for third-party leverage in Section 3.3.4, the new policy-focused Strong Rural Communities research priority attracted fewer supporting third-party organizations compared to other priorities, which impacted this metric. If this continues to be a trend, the targets for this and other metrics may need to be adjusted to reflect the priorities and research questions advanced by the Ministry.

Table 3.51: 2021/22 Number and Type of Third-Party Organizations Supporting Research Projects

Program and Research Priority	Academic / Research	Business / Industry / NGOs	Govern-ment	Total	Agreement Investment	Co-Funders per $1M Invested
Tier I Research	**25**	**86**	**23**	**134**	**$6,961,342**	**19.2**
Animal Health & Welfare	10	25	8	**43**	$2,048,686	**21.0**
Competitive Production Systems	4	20	3	**27**	$1,564,434	**17.3**
Innovative Products	1	7	1	**9**	$523,300	**17.2**
Plant Health & Protection	0	20	1	**21**	$742,060	**28.3**
Soil Health	1	5	3	**9**	$591,500	**15.2**
Strong Rural Communities	1	1	0	**2**	$330,804	**6.0**
Sustainable Production Systems	2	7	3	**12**	$575,400	**20.9**
Water Quality & Quantity	6	1	4	**11**	$585,158	**18.8**
Gryphon's LAAIR	0	6	1	**7**	$412,495	**17.0**
KTT	2	5	0	**7**	$285,400	**24.5**
Total–In Scope Programs	**27**	**97**	**24**	**148**	**$7,659,237**	**19.3**
Special Initiatives				**0**	$280,000	**N/A**
Tiers II and III Research	6	45	15	**66**	$0	**N/A**
Total–Out of Scope Programs	**6**	**45**	**15**	**66**	**$280,000**	**N/A**
Total–All Programs	**33**	**142**	**39**	**214**	**$7,939,237**	**N/A**

Table 3.52 provides number of Co-Funders per $1M invested over the term of the Agreement. The University fell below the target again in 2021/22.

Table 3.52: Number of Co-Funders per $1M Invested over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Number of Co-Funders per $1M Invested	19.2	22.3	19.6	**19.3**		20.0

3.3.7 Number and Type of Collaborations

The Alliance brings together academia, government, and industry to address a common goal – advancing the health, sustainability and productivity of the agri-food and rural sectors in an increasingly complex world. The Alliance fosters collaboration, investment, and engagement for the benefit of Ontario.

Table 3.53 illustrates the number and type of research collaborators engaged in Agreement-funded research by program and research priority. A target of 35 collaborators per $1M invested has been set. In 2021/22, the University fell 2% short of the target with an outcome of 34.2 collaborators per $1M invested for all in scope programs. This was an 8% increase from the 2020/21 value of 31.7 collaborators per $1M invested.

On further analysis of the data, an issue with the metric itself has become evident. In general, for Tier I, the average number of collaborators per project only differs slightly year to year. It was 4.3 collaborators per project in 2019/20 (a year when the target was achieved), 4.1 collaborators per project in 2020/21, and grew to 4.5 collaborators per project in 2021/22. In the same time frame, the average project award increased from $121K to $142K. The $21K increase in award value did not translate into notably larger teams, nor would it be expected to based on research team design. However, the metric of collaborators per $1M invested considers both parameters. If the average award value remained the same between 2019/20 and 2021/22, then the

collaborators per $1M invested for Tier I would have been 37.2 in 2021/22, which would have exceeded the target by 6%. With the increase in award amounts, this metric will need to be adjusted going forward.

In the meantime, the University will continue to encourage researchers to verify that their teams contain the appropriate expertise to successfully complete the project, as well as ensure broad representation from different sectors so that the project's results are relevant and shared appropriately.

Table 3.53: 2021/22 Number and Type of Research Collaborations by Program and Research Priority

Program and Research Priority	Academic / Research	Business / Industry / NGOs	Govern-ment	Total	Agreement Investment	Collab. per $1M Invested
Tier I Research	**120**	**30**	**70**	**220**	**$6,961,342**	**31.6**
Animal Health & Welfare	39	2	19	**60**	$2,048,686	**29.3**
Competitive Production Systems	23	8	20	**51**	$1,564,434	**32.6**
Innovative Products	4	7	5	**16**	$523,300	**30.6**
Plant Health & Protection	14	3	11	**28**	$742,060	**37.7**
Soil Health	12	3	4	**19**	$591,500	**32.1**
Strong Rural Communities	4	0	1	**5**	$330,804	**15.1**
Sustainable Production Systems	15	6	3	**24**	$575,400	**41.7**
Water Quality & Quantity	9	1	7	**17**	$585,158	**29.1**
Gryphon's LAAIR	4	10	3	**17**	$412,495	**41.2**
KTT	13	9	3	**25**	$285,400	**87.6**
Total–In Scope Programs	**137**	**49**	**76**	**262**	**$7,659,237**	**34.2**
Special Initiatives	4	0	3	**7**	$280,000	**N/A**
Tiers II and III Research	52	4	5	**61**	$0	**N/A**
Total–Out of Scope Programs	**56**	**4**	**8**	**68**	**$280,000**	**N/A**
Total–All Programs	**193**	**53**	**84**	**330**	**$7,939,237**	**N/A**

Table 3.54 provides the number of collaborators per $1M invested over the term of the Agreement. The University fell below the target again in 2021/22, after surpassing it in the first two years.

Table 3.54: Number of Collaborators per $1M Invested over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Number of Collaborators per $1M Invested	41.5	38.8	31.7	**34.2**		35.0

3.3.8 Intellectual Property

The Research Innovation Office supports the Agreement through its management of Intellectual Property generated from the commercialization of Agreement-funded program activities. The 2021/22 performance metrics for the commercialization of Agreement-funded program activities are illustrated in the tables below.

Table 3.55 illustrates patent filings and allowances, including plant breeders' rights, related to Agreement-funded program activities, broken out by research theme. A target of 17 patents filed has been set, which was exceeded in 2021/22. Four patents were issued, slightly lower than the target of five. This metric can be highly variable, as RIO does not have control over the schedule of evaluations/issuances by the Canadian Intellectual Property Office (CIPO), the United States Patent and Trademark Office (USPTO), or other patent offices around the world.

Table 3.55: 2021/22 Patents Filed and Issued by Research Theme

Research Theme	Number of Patents Filed	Number of Patents Issued
Bioeconomy	1	1
Products and Value Chains	8	1
Production Systems - Animals	0	1
Production Systems - Plants	17	1
Total	**26**	**4**

Table 3.56 provides the number of patents filed and issued over the term of the Agreement.

Table 3.56: Number of Patents Filed and Issued over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Number of Patents Filed	10	20	20	**26**		17
Number of Patents Issued	4	12	3	**4**		5

Table 3.57 provides the number of OMAFRA-related licenses granted in 2021/22, broken out by research theme. The target is 19 licenses granted. The University exceeded the annual target with 25 licenses granted. The total number of licenses entered into for 2021/22 speaks to the dedication of the technology transfer staff and their ability to pursue opportunities despite a second year of working mostly from home.

One of the licenses is an option for a technology related to safer fumigation of packaging materials that carry fresh produce. The option is the result of a successful application to the CFIA's Innovative Solutions Canada program with iFood Packaging Systems, a Canadian company that designs systems for transporting produce around the world. The initial project was successful, so CFIA invited the company to apply for Phase 2 funding worth more than $1M. The same technology is the subject of an ongoing OMAFRA-supported Proof of Principal grant to determine its utility in soil fumigation.

There were 22 agreements related to plant varieties, spanning four different crop species. These included three agreements with companies that have licensed varieties from UofG for the first time, and UofG's first license of a kintoki-type dry bean, which will be grown primarily for export markets.

Table 3.57: 2021/22 Licenses and Amending Agreements Granted by Research Priority

Research Theme	Number of Licenses
Products and Value Chains	2
Bioeconomy	1
Production Systems - Plants	22
Total	**25**

Table 3.58 illustrates the number of licenses granted over the term of the Agreement. The University has surpassed the annual target in each of the last four years.

Table 3.58: Number of Licenses Granted over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Number of Licenses	22	20	35	**25**		19

Table 3.59 shows the total dollar value of revenue generated from licenses associated with OMAFRA-supported research. A total of $1.58M was generated, which exceeds the target of $1.5M, though a decrease from 2020/21. The high immune response technology, marketed as Immunity+ by Semex, is still doing well. Five individual varieties had revenues exceeding $100K, including two soybean varieties (one from the Guelph program and one from the Ridgetown program), one tomato line, a kidney bean line, and an asparagus line.

Table 3.59: 2021/22 License Revenue Generated by Type

Type of License Revenue	License Revenue Generated
Non-seed	$310,047
Seed	$1,271,209
Total	**$1,581,255**

Table 3.60 provides the licence revenue generated over the term of the Agreement. The University has exceeded the target in each of the last four years.

Table 3.60: License Revenue Generated over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
License Revenue Generated	$1,675,704	$1,562,888	$1,732,283	**$1,581,255**		$1,500,000

Table 3.61 identifies the number of new inventions reported to RIO in 2021/22 from Agreement-funded research. The inventions are broken out by research theme. There is no specific target because the numbers are highly variable from year to year, with the majority being new plant varieties.

Table 3.61: 2021/22 Intellectual Property Disclosures by Research Theme

Research Theme	Number of Intellectual Property Disclosures
Bioeconomy	2
Products and Value Chains	2
Production Systems - Animals	2
Production Systems - Plants	48
Total	**54**

Table 3.62 shows the number of intellectual property disclosures over the term of the Agreement. For 2021/22, the number is artificially low because soybean disclosures were not reported by the year-end cut-off date.

Table 3.62: Number of Intellectual Property Disclosures over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23
Number of Intellectual Property Disclosures	183	154	171	**54**	

3.4 Reporting Requirements

3.4.1 Knowledge Translation and Transfer Activities

The purpose of Knowledge Translation and Transfer Activities is to advance knowledge into action through synthesis, exchange, application, and dissemination. Activities build on a foundation of agricultural extension to support collaboration, technology transfer, and implementation of research results. KTT activities result from interactions among one or more of the University, University researchers, the Ministry, various internal and external stakeholders, and members of the public.

Table 3.63 provides the number and type of KTT activities in research projects by program, while Table 3.64 shows the number and type of publications in research projects by program. This metric was changed from a Key Performance Indicator to a Reporting Requirement, so it has no target. In 2021/22, 1,638 unique KTT activities were reported on by researchers. This is a 65% increase from the 991 KTT activities reported in 2020/21. An RMS issue necessitated a change in the reporting methodology for KTT activities in 2021/22. Likely, a portion of the 65% increase can be attributed to this methodology change.

Table 3.63: 2021/22 Number and Type of Knowledge Translation and Transfer Activities by Program

Program	Mobile Apps, Social Media, Web	Workshops, Tradeshows, Conferences	Committees, Consultations, Networks	Courses / Training Tools	Brochures, Multimedia, Factsheets	Other	Total
Tier I Research	77	426	104	20	71	26	**724**
Gryphons LAAIR	1	4					**5**
HQP Scholarship Program	7	111	15	7	15	3	**158**
KTT Program	14	30	5	2	20	1	**72**
Special Initiatives		10	20	1	1	1	**33**
Tiers II and III Research	20	143	4	1	13	4	**185**
USEL Program		8					**8**
Total	**119**	**732**	**148**	**31**	**120**	**35**	**1,185**

Table 3.64: 2021/22 Number and Type of Publications by Program

Program	Journal Article	Magazine/ Newspaper Article	Report	Thesis	Trade Publication	Web Article	Other	Total
Tier I Research	147	36	36	32	8	12	35	**306**
Gryphons LAAIR	2							**2**
HQP Scholarship Program	23		7	4		1	4	**39**
KTT Program	8	1	6	1		2	3	**21**
Special Initiatives	5		1	1			1	**8**
Tiers II and III Research	41	1	7	3	6	12	7	**77**
USEL Program								**0**
Total	**226**	**38**	**57**	**41**	**14**	**27**	**50**	**453**

Table 3.65 provides the number of KTT activities over the term of the Agreement.

Table 3.65: Number of KTT Activities over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23
KTT Activities	920	1,083	991	**1,638**	

3.4.2 Research Innovation Office – Liaison Activity

The Industry Liaison team had a productive year helping industry partners and University researchers engage in successful projects, despite several external challenges. Restrictions and closures related to COVID-19 had an impact on the IL team's business development activities, namely limiting introductions and in-person meetings that are critical components of developing a project pipeline and overall research activity.

Despite challenges, the IL team saw increases across the board in terms of clients helped, projects initiated, projects awarded, and value of projects. Of the 41 awarded projects, more than half were related to OMAFRA priorities, including six of the eight largest ones (greater than $500K).

Table 3.66 delivers quantitative data for clients helped, projects initiated, deals made, and the value of closed projects. Table 3.67 shows the number and value of closed projects over the term of the Agreement. Finally, Table 3.68 provides a project listing of all closed projects in 2021/22.

Table 3.66: 2021/22 Industry Liaison Activity Details

Activity	Results
Number of Clients Helped (Total)	130
Inquiries	42
Introductions Made	37
Number of Projects Initiated	70
Number of Projects Closed (Awarded)	41
Value of Closed Projects	$19,275,880

Table 3.67: Number and Value of Closed Projects over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23
Number of Closed Projects	31	25	34	**41**	
Value of Closed Projects	$7,155,690	$5,652,738	$6,728,602	**$19,275,880**	

A few successful projects were quite large and contributed to the significant value of closed projects in 2021/22. For example, both Dr. Stephen LeBlanc and Dr. Gisele LaPointe were awarded large grants that together were valued over $9M related to dairy herd management and dairy microbiology. RIO contributed to these by providing advice to the faculty members and their partners and participating in the review process.

Also, several large projects were able to leverage Tier I funds with partner organizations. For example, Dr. Manju Misra was able to leverage funds from Tier I and Ontario Pork to the NSERC Alliance program to build a $589K project to develop biodegradable truck liners for deadstock in case of a disease emergency. Dr. Elijah Kiarie was also able to leverage Tier I funds to build a more than $700K project related to improving poultry nutrition. Together, nine Tier I projects linked to Canadian partner organizations and companies were able to leverage the NSERC Alliance program in 2021/22, a success that was achieved through increased touchpoints among RIO, the Office of Research Agri-Food Partnership, and the Office of Research Services.

Table 3.68: 2021/22 Project Listing for Closed Projects (Deals Made)

Lead Applicant	Project Title	Industry Partner	Program	Total (All Sources)
Tariq Akhtar	A biosynthesis platform for bioactive phenolics	Atlas 365	OCI VIP	$272,800
Leah Bent	PING - Putter Project	PING	Research Contract	$31,220
Gale Bozzo	Investigation of practices and technologies for lion's mane production, an emerging medicinal mushroom for Canada	Whitecrest Mushrooms Ltd	NSERC Alliance	$234,000
Gale Bozzo	Increasing shelf life of mushrooms through postharvest practices	Mushrooms Canada	NSERC Alliance Option 2	$273,700
Emily Chiang	Development of rapid quantification of soil organic carbon pools via photocatalytic kinetics	ManTech	NSERC Alliance	$60,000
Ali Dehghantanha	Cyber threat intelligence integration with MISP	Bruce Power	Mitacs Accelerate	$15,000
Ali Dehghantanha	Creating a comparison and alert methodology for the CCTX Feed	Canadian Cyber Threat Exchange	Mitacs Accelerate	$15,000
Ali Dehghantanha	TBD - Fairly.ai project	Fairly.ai	Mitacs Accelerate	$60,000
Lisa Duizer	Extension of shelf life and commercialization of 1858 Elixr line of products	1858 Caesar	OCI VIP	$60,000
Milad Eskandari	Genetic dissection of the resistance to Soybean Cyst Nematode (SCN) using advanced functional genomic tools	Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)	NSERC Alliance	$274,940
Andrew Gadsden	Development of intelligent linear axis digital twin for health condition monitoring	Ford Motor Company	NSERC Alliance	$397,470
Thomas Graham	Evaluation of a novel hydroponic solution additive	MetaFlo Technologies Inc.	Grant in Aid	$8,396
David Huyben	Improving fish gut health and disease resistance by feeding insects and probiotics	OMAFRA	NSERC Alliance	$263,190
Hadis Karimipour	Claims fraud monitoring using graph neural networks	Munich RE	Mitacs Accelerate	$30,000
Hassan Khan	Members Netflow data project	Canadian Cyber Threat Exchange	Mitacs Accelerate	$15,000
Elijah Kiarie	Impact of maternal and perinatal feeding of enzymatically hydrolyzed yeast cell walls on	OMAFRA	NSERC Alliance	$737,364

Lead Applicant	Project Title	Industry Partner	Program	Total (All Sources)
	growth performance and immunoco			
Jasmin Lalonde	Investigating Cannflavins A and B as Inhibitors of TrkB Signalling for Treatment of Glioblastoma Multiforme	Canurta	Mitacs Accelerate	$120,000
Gisele LaPointe	TBD	Dairy Farmers of Ontario	NSERC Alliance	$5,301,000
Stephen LeBlanc	Sustainable health management for dairy cattle in Canada	Dairy Farmers of Ontario	NSERC Alliance	$3,975,000
Jana Levison	Understanding groundwater, agronomy and drainage system design influences on tile water quantity and quality	University of Guelph	NSERC Alliance Option 2	$243,700
Huiyan Li	Development of a high-yield and high-purity isolation kit for extracting extracellular vesicles from complex biological	Galenvs	NSERC Alliance	$130,000
Loong-Tak Lim	Sustainable fumigants to replace methyl bromide by ethyl formate, ClO2 and other volatiles	iFood Packaging Systems Corp.	Innovative Solutions Canada Project Grant	$57,500
Xiaodong Lin	Automated AI-based phishing solution	KPMG	Mitacs Accelerate	$15,000
Alejandro Marangoni	Structure-function relationships in high-protein plant-based cheese	Daiya Foods	Research Contract (NSERC Alliance Pre-Award)	$150,000
Judi McCuaig	TBD	KnowMeQ	Research Contract	$8,960
Manjusri Misra	Biodegradable plastic truck liners for Ontario deadstock disposal	OMAFRA	NSERC Alliance	$589,000
Jonathan Munn	Real-time groundwater monitoring of a quarry reclamation within the City of Guelph for source water protection	City of Guelph	NSERC Alliance	$860,857
Joshua Nasielski	Developing best management practices for late nitrogen applications in corn	Grain Farmers of Ontario	NSERC Alliance	$346,290
Charlie Obimbo	Reporting automation platform	ISA Cybersecurity	Mitacs Accelerate	$15,000
Andrew Peregrine	Utility of the carbohydrate larval antigen (CarLA®) saliva test to lower the risk of gastrointestinal parasitism in Onta	OMAFRA	NSERC Alliance	$396,996

Lead Applicant	Project Title	Industry Partner	Program	Total (All Sources)
Ryan Prosser	TBD - long-term ecological effects of diesel oil on marine populations	Heiltsuk Integrated Resource Management Department	NSERC Alliance	$356,167
Anna Kate Shoveller	TBD	Charmy Box Shop	Mitacs BSI	$20,000
Anna Kate Shoveller	Changing the energy game and moving towards precision delivery of dietary energy	Petcurean	NSERC Alliance	$238,258
Michael Steele	Determining the impact of prepartum energy intake on colostrum quality and calf performance to improve beef calf health	Alberta Beef Producers	NSERC Alliance	$534,000
Michael Steele	Finding solutions to alleviate gastrointestinal health in dairy cows and calves	Dairy Farmers of Ontario	NSERC Alliance	$750,000
Francois Tardif	Herbicides and cover crops for improved corn establishment	Grain Farmers of Ontario	NSERC Alliance	$200,000
Peter Tremaine	High temperature aqueous chemistry for sustainable nuclear power generation	University Network of Excellence in Nuclear Engineering	NSERC Alliance	$2,099,367
Siavash Vahidi	Identifying the site of interaction of ClpP inhibitors using biomolecular mass spectrometry methods	Ontario Institute for Cancer Research (OICR)	Research Collaboration Agreement	$0
Sheng Yang	Development of a cloud-based digital twin simulation platform for flexible manufacturing systems with IoT technology	Aleo Canada Inc	NSERC Alliance	$30,000
John Zandstra	Evaluation of cricket frass in fruit and vegetable cropping systems	Aspire Food Group	Service Contract	$50,705
Richard Zytner	Stress test of a pilot passive methane oxidation barrier	Dillon Consulting Ltd	Mitacs Accelerate	$40,000
Total				**$19,275,880**

3.4.3 Intended Benefit

The Intended Benefit reporting requirement identifies, from an end-user perspective, the primary beneficiary and benefit or impact of a research project. For Intended Benefit, research projects are classified as: 1) Adoption of New Technologies, Products, Practices and Processes; 2) Applied Research – Technology Assessment; 3) Applied Research – Technology Demonstration; 4) Applied Research – Technology Development; 5) Applied Research – Not Involving Technology Development; 6) Discovery Research; 7) IP Protection; 8) Knowledge Translation and Transfer; and 9) Public Policy Research. Table 3.69 below provides the Intended Benefit for the 2021/22 research projects.

Table 3.69: 2021/22 Intended Benefit by Program and Research Priority

Program and Research Priority	Adoption of New Tech.	Applied Res. - New Tech. Assess.	Applied Res. - New Tech. Demo.	Applied Res. - New Tech. Develop.	Applied Res. – Not New Tech.	Discovery Research	IP Protection	KTT	Public Policy Res.	Total
Tier I Research	6	8	3	14	9	4			5	49
Animal Health & Welfare	*2*	*3*	*1*	*4*	*4*	*3*			*1*	*18*
Competitive Production Systems	*1*	*2*		*4*	*3*					*10*
Innovative Products			*1*	*1*		*1*				*3*
Plant Health & Protection	*1*		*1*	*2*	*1*					*5*
Soil Health	*1*			*2*					*1*	*4*
Strong Rural Communities									*2*	*2*
Sustainable Production Systems	*1*	*2*							*1*	*4*
Water Quality & Quantity		*1*		*1*	*1*					*3*
Gryphon's LAAIR	1	1	2	2						6
KTT								6		6
Special Initiatives									1	1
Tiers II and III Research	2	6	1	11	4	3				27
Grand Total	**9**	**15**	**6**	**27**	**13**	**7**	**0**	**6**	**6**	**89**

3.4.4 Impact Case Study

The Impact Case Study is a qualitative assessment and accompanying narrative that illustrates the cumulative impact of research and KTT activities on the end-user audience. The case study approach involves assessment across multiple elements and requires the use of mixed methodologies (e.g., document review (research proposals and reports, grey literature - government and industry reports, academic presentations, statistical data sources), media scans, interviews with researchers and end users etc.).

Impact, for this purpose, is defined as any type of output of research activities which can be considered a net "positive return" for the scientific community, end users (government policy and program development, business, and industry etc.) or civil society. Five broad categories have been identified for the case studies to assess and describe impact, which recognize the multi-dimensional nature of the benefits of research - from traditional knowledge generation and capacity building through to broader sector and societal benefits. These categories are: advancing knowledge; capacity building; informing decision-making; sector benefits; and broad socio-economic benefits.

Three discrete case studies were completed in time for the mid-term review of the Agreement. Each case study covered a reasonably broad topic area to illustrate the diversity of funded research, with more specific topic areas ("vignettes") selected for deeper assessment to demonstrate longer-term impact.

The first case study on Dairy was submitted with the 2019/20 Consolidated Annual Report on July 31, 2020. The second case study on Breeding and Genetics was submitted on March 19, 2021. The third case study on Innovation was submitted on June 30, 2021. This was the last case study that will be completed during the first term of this Agreement. On September 17, 2021, the Alliance Executive Committee acknowledged the completion of the ICS requirements for the 2018 OMAFRA-UofG Agreement.

3.4.5 Agri-Food and Rural Link – KTT Activity

Agri-Food and Rural Link is the program delivery and training arm of the Alliance's KTT program. AFRL programming is designed to improve KTT capacity among researchers, graduate students, and regional agri-food partners to enhance the impact of research. Program staff, in collaboration with OMAFRA and UofG partners, also design and execute targeted communication strategies and events to enhance knowledge exchange and dissemination. Table 3.27 in Section 3.1.7 contains a comparative summary of KTT activities noted in the 2021/22 Business Plan, relative to the activities that took place in 2021/22.

3.4.6 Agri-Food and Rural Link and Research Innovation Office Outcomes

Both Agri-Food and Rural Link and the Research Innovation Office deliver programming to enhance the impact of research outside academia. Three case studies are included in Appendix B to illustrate the impact of effective knowledge mobilization, innovation, and commercialization activities delivered by AFRL and RIO. Taken together, these case studies profile the breadth of activities which increase capacity of both researchers and stakeholders to extend and receive research results and demonstrate how program capacity enhances the impact of research projects on the target audiences.

Appendix B.1 – KTT Mobilization Initiatives Program: A Tool to Enhance Research Impact
The KTT Mobilization Initiatives (KTT-I) Program provides one-time funding of up to $5,000 for an activity that mobilizes research findings within the agri-food community. This case study profiles the structure of the KTT-I program, highlights one of its success stories – extension materials produced by the Honey Bee Research

Centre at the University of Guelph — and demonstrates how a small investment can make a big difference in getting the news out about research.

Appendix B.2 – Undergraduate Student Experiential Learning Program: Experiential Learning Opens New Doors for UofG Undergrads
The USEL Program gives undergraduate students access to summer jobs that hone their KTT skills and engage their expertise to investigate pressing problems in the agri-food sector. The result is an experiential learning opportunity that supports students and the sector. This case study profiles the program and tells the story of how it has made a difference for two student participants.

Appendix B.3 – Breeding Innovation: How the UofG's Research Innovation Office Helps Bring New Crop Varieties to Ontario Markets
The Ontario Agri-Food Innovation Alliance invests in a research and innovation ecosystem that makes an impact by bringing new, useful crop varieties to market. This case study looks at the role RIO plays in bringing new crop varieties to market, from supporting industry collaborations to enabling intellectual property protection, and focuses on one facet of RIO's work - the recently reinstated wheat breeding program.

3.4.7 Third-Party Investment in Tiers II and III Projects

Tiers II and III projects have operating funding from non-Agreement programs or partners for research that supports Ministry or government priorities. These projects receive support from the Agreement through subsidized Research Centre Access Fees and/or use of funded technicians. Table 3.70 shows the number of co-funders, as well as the value of third-party research operating funding directed at Tiers II and III research projects by type. Only cash contributions have been utilized in calculating the third-party investment, as well as the number of co-funders.

For projects beginning in 2021/22, the total third-party operating funding for Tiers II and III projects was $6.7M from 66 different co-funders. This was a decrease in funds from the $11.6M recorded in 2020/21, but an increase in the number of co-funders. Most of the financial partners are in the Business / Industry / NGOs type (68% by funding amount) which clearly indicates that the University is addressing the needs and economic prosperity of the agri-food sector.

Table 3.70: 2021/22 Third-Party Operating Funding Directed at Tiers II and III Research Projects

Research Priority	Academic		Business / Industry / NGOs		Government		Total	
	#	Amount	#	Amount	#	Amount	#	Amount
Animal Health & Welfare	5	$286,311	18	$1,421,442	13	$2,132,422	36	$3,840,175
Competitive Production Systems	1	$40,743	3	$107,530	1	$18,000	5	$166,273
Innovative Products	0		4	$1,782,345	0		4	$1,782,345
Plant Health & Protection	0		16	$448,148	1	$8,400	17	$456,548
Sustainable Production Systems	0		4	$476,207	0		4	$476,207
Total	**6**	**$327,054**	**45**	**$4,235,672**	**15**	**$2,158,822**	**66**	**$6,721,548**

Table 3.71 provides the number of co-funders and the value of third-party operating funding directed at Tiers II and III projects over the term of the Agreement. These metrics tend to vary year to year.

Table 3.71: Number of Co-Funders and Value of Third-Party Funding for Tiers II and III Research Projects over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23
Number of Co-Funders	46	39	59	**66**	
Value of Third-Party Operating Funding	$7,623,824	$2,786,280	$11,574,265	**$6,721,548**	

3.4.8 HQP Scholarship Program and USEL Program

The HQP Scholarship Program provides scholarships for University of Guelph graduate students to enhance their skills and knowledge of the agri-food sector. This has a direct benefit to the students, their future employers, and the agri-food sector. In 2021/22, scholarships were awarded to eight new Masters and six new Doctoral students. In addition, there were 11 continuing Masters and 20 continuing Doctoral students, for a total complement of 45 students.

The USEL Program supports the mobilization of agri-food research findings and the Ministry's ability to source qualified talent for branch positions, leveraging resources to deliver on industry and Ministry priorities. In 2021/22, the USEL Program supported ten students who completed their projects during Summer 2021.

3.4.9 Status of the University's Project to Create a Platform for Agri-Food Data in Accordance with D.2 of the Program Schedule

Agri-food Data Canada (ADC) is envisioned to be a national data ecosystem that connects nodes of existing agri-food research data across Canada.

As detailed in the 2019/20 Consolidated Annual Report, the development of ADC will require an iterative, phased methodology to achieve its mandate to bring agri-food research data together with advanced analytics to create new opportunities for the agri-food sector. In 2020/21, this iterative process led to the development of a new approach to ADC as a federated data ecosystem that strives to connect agri-food data nodes from research datacentres across Canada, including the UofG's Research Centre Data Access Portal.

In 2021/22, the Agri-food Data Canada portfolio again experienced a period of staffing transition. In April, Dr. Michelle Edwards joined the Office of Research as the inaugural Director of Agri-Food Data. The new director role expands on the former position of Senior Manager, Data Strategy for the Food from Thought (FfT) program and is part of the University's long-term commitment to foster agri-food data excellence. The position will work to create systems and tools to harness data from two foundational funding programs - Food from Thought and the Ontario Agri-Food Innovation Alliance. It will also provide important stability and support continuity for the oversight of data initiatives at the University while building relationships and identifying new partnership opportunities.

As part of ADC's commitment to develop a well-governed, integrated ecosystem for agri-food research data at the University of Guelph and beyond, the FfT program issued a call for proposals in 2021/22 for three priority areas, one of which was projects that support FfT's data strategy and the development of Agri-food Data Canada. The projects, enabled by this funding, will support ADC's work to develop a service catalogue that will help meet researcher needs and the needs of the broader agri-food data ecosystem.

In May 2022, FfT announced the award of eight projects totalling $2.6M that are part of the data strategy theme. As these projects get underway, researchers will work with the ADC team to assess and meet each

project's data management needs in support of FAIR data principles. These projects and the resulting contributions to the ADC service catalogue will be discussed in the 2022/23 Consolidated Annual Report.

More information about the FfT Thematic III Research Fund, including the data stream, can be found in the research funding announcement on the Food from Thought website.

3.4.10 Administration of the Germplasm Bank

The total revenue for the Germplasm Bank was $1.27M in 2021/22, a slight decrease from the previous year. This total has been reported based on an April 30th year end to maintain consistency with the rest of the report. Previously, the germplasm portfolio was reported based on a March 31st year end. Table 3.72 provides additional revenue details by crop.

Dry bean revenues were down 24% compared to 2020/21, however 2021/22 was still the second highest year ever. The primary contributor is once again the Dynasty dark red kidney bean. This variety comprises 90% of Ontario's dark red kidney bean acreage and more than half of the acreage in North America. Dynasty recently won the 2022 Seed of the Year at the Canadian Plant Breeding Innovation Awards. For soybean, overall royalties were down considerably. OAC Strive and OAC Bruton were again the top performers.

Asparagus had another strong year in 2021/22. The licensee Fox Seeds continues to invest in building the company and expanding markets. Tomato royalties were higher than normal because two years' worth of payments were recorded in 2021/22, due to the licensee being late the previous year. Royalties for rutabaga were received for the first time in 2021/22. Rutabaga resistance to root maggot was developed by Dr. Laima Kott's program and licensed in 2016.

The University has been pursuing a strategy of increased IP protection related to crop varieties. In 2021/22, fourteen Plant Breeders' Rights applications and three trademark applications were submitted.

Finally, it should be noted that the position of Technology Transfer Manager – Germplasm was vacant from June to September 2021. The position was filled in October 2021 by Ms. Rebecka Carroll, who brings experience, professionalism, and dedication to the role. She is expected to have an immediate impact on the germplasm portfolio.

Table 3.72: 2021/22 Germplasm Revenue by Crop Type

Crop Type	Germplasm Revenue
Field Crops	**$926,940**
Bean - white and coloured	$198,505
Canola	$3,896
Cereals - Guelph	$38,295
Cereals - Ridgetown	$30,446
Forages	$5,281
Maize	$0
Soybean - Guelph	$414,068
Soybean - Ridgetown	$236,449
Horticultural Crops	**$344,269**
Apple rootstocks	$7,104
Asparagus	$210,848
Hemp	$4,701
Rutabaga	$1,584
Strawberry	$1,460
Tomato	$114,098
Tree fruit	$4,475
Total Germplasm Revenue	**$1,271,209**

Table 3.73 provides the Germplasm Revenue over the term of the Agreement.

Table 3.73: Germplasm Revenue over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23
Germplasm Revenue	$1,320,716	$1,180,520	$1,346,310	**$1,271,209**	

4 VETERINARY CAPACITY PROGRAM

The Veterinary Capacity Program (VCP) supports the development of future skilled capacity to be ready for employment opportunities offered by the agri-food sector and rural Ontario, including having highly qualified veterinary capacity in place to meet Ontario's needs.

4.1 Program Activities and Achievements from 2021/22

VCP is a well-established, stable program, which contributes to the development of Ontario's veterinary capacity, providing students with the knowledge and skills needed to meet the needs of the Ministry, the agri-food sector, veterinary public health, and rural economic development. VCP funding enables hands-on, experiential learning in the innovative, clinical environment at the Ontario Veterinary College (OVC) Health Sciences Centre and supports approximately 11 faculty FTEs, a subset of the 56 OVC faculty that engage in areas of interest to OMAFRA.

Congruent with OMAFRA priorities, in year four of the program, OVC continued to enhance partnerships and networks with health authorities, industry and academia to expand capacity in One Health research. OVC also maintained efforts to influence societal change by increasing involvement in relevant government and industry discussions and decisions related to veterinary medicine and One Health. This important work is highlighted on the UofG's One Health website.

In effort to address the shortage of veterinarians nationwide, OVC is advocating to the Ontario government for the expansion of the Doctor of Veterinary Medicine (DVM) program, presenting a compelling Collaborative DVM Program in partnership with Lakehead University. The program would see twenty students a year complete the first two years of the program at Lakehead and then transition to Guelph for the years three and four. The program would boost veterinarian capacity in Ontario's North, where the shortage is most severe. The reception to the proposal has been positive, but funding decisions have not been made to date. OVC remains hopeful that funding will be secured in 2022/23, as other provinces have recognized the scale and impact of the veterinarian shortage and committed funds to expand DVM programs at other Canadian veterinary schools.

The VCP continues to provide all DVM students with:

- Experience with and exposure to Priority Species;
- Knowledge of livestock production practices at the intersection of animal and human health as part of the University of Guelph's One Health agenda;
- Opportunities to develop practical competency through experiential learning and field experience;
- Opportunities to gain awareness in emerging animal health issues; and
- Awareness of veterinarians' roles in areas of practice beyond primary care, including government, public health, public policy, and regulatory roles.

Candidates for the Doctor of Veterinary Science (DVSc) and Doctor of Philosophy (PhD) degrees, as well as trainees in other post-graduate programs, are provided with research opportunities for priority species and Ministry priorities.

This year, once again, OVC is celebrating a top ten ranking among veterinary schools in the world through the Quacquarelli Symonds (QS) university rankings. The QS World University Rankings by Subject 2022 ranked

OVC fifth worldwide (the same as last year), as well as first in Canada and third in North America.[21] OVC has consistently placed among the top ten institutions since QS first included veterinary science in their rankings in 2015. Ranking is based on academic and employer reputation, as well as how often faculty research is cited within academic publications.

COVID-19

Since the beginning of the COVID-19 pandemic and throughout the reporting period, OVC conducted academic activities in a modified format compliant with public health directives. Teaching and research were actively pursued throughout the pandemic. As a result, there were no material impacts to the activities in the Veterinary Capacity Program under the Agreement.

4.2 Mandatory Compliance Requirements

4.2.1 OVC Accreditation

Veterinary programs in Canada, the United States, as well as programs in the leading schools throughout the rest of the world, are accredited by the Council on Education (COE) of the American and Canadian Veterinary Medical Associations (AVMA; CVMA). The accreditation status of OVC is reviewed annually based on its annual report submission. During its March 2022 meeting, the American Veterinary Medical Association Council on Education (Council) reviewed the College's 2021 interim report. The Council voted to continue accredited status for the Ontario Veterinary College. OVC is actively preparing for the accreditation site visit scheduled to take place in October 2022.

4.2.2 Capacity Strategy Plan Acknowledgement

OVC maintains a Capacity Strategy Plan to ensure that they have the faculty and staff necessary to service VCP and support capacity needs for priority species and Ministry priorities. The recruitment and retention of faculty and staff is of critical importance. In fact, OVC's Healthy Futures Strategic Plan webpage identifies a key objective to attract and retain the very best talent. When hiring, OVC continues to reflect on the priority species and Ministry priorities.

Eight new faculty members started their appointments in 2021/22 in Ministry priorities and/or emerging areas:

- Anatomic Pathology – Dr. Emma Borkowski
- Large Animal Surgery – Dr. Marie-Soleil Dubois
- Qualitative Research Methods and Knowledge Synthesis – Dr. Basem Gohar
- Public Health – Dr. Lauren Grant
- Veterinary Anatomy – Dr. Samantha Payne

[21] "QS World University Rankings by Subject 2022: Veterinary Science," Quacquarelli Symonds (QS) Top Universities, accessed July 21, 2022, https://www.topuniversities.com/university-rankings/university-subject-rankings/2022/veterinary-science

- Anatomic Pathology – Dr. Courtney Schott
- Epidemiology and One Health – Dr. Kelsey Spence
- Community Medicine (Veterinary) – Dr. Laura Van Patter

In addition, the following relevant positions will be filled in 2022/23:

- Large Animal Surgery – Dr. Nicola Cribb
- Large Animal Surgery – TBD
- Theriogenology – Dr. Michelle Caissie
- Veterinary Bacteriology – TBD
- Epidemiology and Dairy Health Management – TBD
- Diagnostic Imaging - TBD
- Ruminant Health Management -TBD

4.2.3 Resources to Administer VCP

OVC confirms that the necessary resources, including faculty and support staff, are available to administer the Veterinary Capacity Program. Mr. Ilya Bogorad, Executive Director, Strategy and Planning, Ontario Veterinary College, plays a leadership role as the VCP PMC Co-Chair.

4.3 Key Performance Indicators

4.3.1 NAVLE Results

The North American Veterinary Licensing Exam (NAVLE) is the standardized licensing test that graduates of accredited schools can take in the final year of their program. Success allows OVC graduates to obtain licensure to practice anywhere in the world. As noted in Table 4.1, OVC graduates continue to demonstrate a high success rate for the NAVLE, based on the percentage who pass and the score obtained, which are both consistently higher than the average outcomes for the entire North American cohort. In 2021/22, 93% of OVC soon-to-be graduates passed the test compared to 85% of the North American cohort.

It is important to note that NAVLE results clearly demonstrate the very tangible value of the Veterinary Capacity Program. Graduates of OVC consistently outperform graduates of other veterinary schools on questions related to OMAFRA's priority species. On questions related to food animals, the OVC cohort scored a full six percentage points higher than the North American average.

Table 4.1: NAVLE Results

Graduation Year	OVC Student Exam Score[22]	North American Cohort Exam Score	% Pass Rate for OVC	% Pass Rate for North American Cohort
2022	522	494	93%	85%
2021	528	504	96%	90%
2020	511	501	93%	89%
2019	525	507	99%	94%
2018	515	509	97%	95%

4.3.2 Student Alignment with Priorities

This key performance indicator measures the number of students enrolled in post graduate studies aligned with Ministry priorities. The target is fifteen graduate students. OVC achieved the target in 2021/22. Table 4.2 provides the project titles for the fifteen doctoral students receiving stipend support. Table 4.3 shows the number of students enrolled in post graduate studies aligned with Ministry priorities over the term of the Agreement. The University has achieved the target in each of the last four years.

Table 4.2: Project Titles and Status of Students receiving VCP Funding

Project Title	Specialty Area	Degree	Ministry Priority	Entry Semester
Crimean-Congo hemorrhagic fever DNA vaccine trial: pilot safety and toxicity study in cattle and sheep	Veterinary Pathology / Anatomic Pathology	DVSc	Public Health	S17
Characterisation and investigation of bronchopneumonia with interstitial pneumonia in beef feedlot cattle	Veterinary Pathology / Anatomic Pathology	DVSc	Animal Health	S19
Transmission pathways of aquatic bird bornavirus for poultry species	Comparative Pathology / Avian Pathology	DVSc	Public Health	F19
Sow parturition and the examination of effective management practices in reducing stillbirths and pre-weaning mortality	Epidemiology	PhD	Animal Health	F19
Effect of ESWT on the immunomodulatory and anti-inflammatory properties of MSC	Large Animal Surgery	DVSc	Animal Health	F19
Seminal small RNA markers of bovine fertility	Reproductive Biology	PhD	Animal Health	F19
Investigation of astrovirus as an emerging cause of previously undiagnosed neurologic disease in Ontario cattle	Veterinary Pathology / Anatomic Pathology	DVSc	Animal Health	F19

[22] Exam is scored out of 800.

Project Title	Specialty Area	Degree	Ministry Priority	Entry Semester
Characterization and prospective control methods of an unnamed Eimeria species causing coccidiosis in commercial chukar partridge (Alectoris chukar) flocks	Comparative Pathology / Avian Pathology	PhD	Public Health	W20
Do mast cells play a role in persistent breeding-induced endometritis in the mare?	Theriogenology	DVSc	Animal Health	W20
Validation of a sedation protocol with medetomide, acepromazine and alfaxalone prior to euthanasia in urban wildlife species	Anesthesia	DVSc	Animal Welfare	F20
Radiation safety practises among large animal veterinarians	Radiology / Diagnostic Imaging	DVSc	Animal Health	F20
Role of inflammasomes and IL1β in dysregulated inflammation associated with Bovine Respiratory Disease	Veterinary Pathology	PhD	Public Health	F20
Describing and characterizing neonatal dairy calf mortality in Ontario	Health Management (Dairy Cattle)	DVSc	Animal Health	W21
Pathogenesis and impact of age at time of infection of aquatic bird bornavirus-1 in ducks and turkeys	Veterinary Pathology / Anatomic Pathology	DVSc	Animal Health	S21
Experimental infection of ferrets (mustelids), and assessment of consequent clinical signs and lesions	Veterinary Pathology / Anatomic Pathology	DVSc	Animal Health	F21

Table 4.3: Students in Post Graduate Studies Aligned with Ministry Priorities over the Term of the Agreement

Number of Students in Post Graduate Studies Aligned with Ministry Priorities over the Term of the Agreement	15	15	15			15

4.4 Reporting Requirements

4.4.1 Graduate Survey

This metric includes data from three surveys: the Graduate Survey, which studies new program graduates six months to one year after graduation (i.e., OVC 2021 cohort – students who graduated in June 2021); the Employer Survey, which studies employers of new graduates six months to one year after graduation; and the Alumni Survey, which studies alumni five years after graduation (i.e., OVC 2017 cohort – students who graduated in June 2017). To facilitate comparisons across years, percentages are reported as a function of survey respondents, not total students in the cohort.

4.4.1.1 Results of Graduate and Employer Surveys

Forty-eight of the 120 graduates in OVC 2021 responded to some or all of the survey questions, representing a 40% response rate. Responses were received from 40 employers representing a 33% response rate. Response rates varied for each survey question, and the number of respondents for each question is indicated in brackets after the table or figure title.

Table 4.4 displays the practice category and type that new OVC graduates were employed in six months to one year after graduation.

Table 4.4: Practice Category and Type that New Graduates (OVC 2021) were Employed In (N=46)

Practice Category	Practice Type	Number of Respondents (%)
Clinical Practice	Equine	2 (4%)
Clinical Practice	Food Animal	2 (4%)
Clinical Practice	Rural Community Practice/Mixed	5 (11%)
Clinical Practice	Small Animal	28 (61%)
Clinical Practice	Other Private Clinical Practice	0 (0%)
Non-Clinical Practice	Graduate School	0 (0%)
Non-Clinical Practice	Internship/Residency	8 (17%)
Non-Clinical Practice	Other - Government	1 (2%)

Table 4.5 illustrates the streams that new OVC graduates, completing the Graduate Survey, participated in during fourth year. Stream information was available for 43 of the 48 survey respondents (90%).

Table 4.5: Stream that New Graduates (OVC 2021) Participated in During Fourth Year (N=43)

Stream	Number of Respondents (%)
Equine	5 (12%)
Food Animal	2 (5%)
Rural Community Practice	7 (16%)
Small Animal	29 (67%)

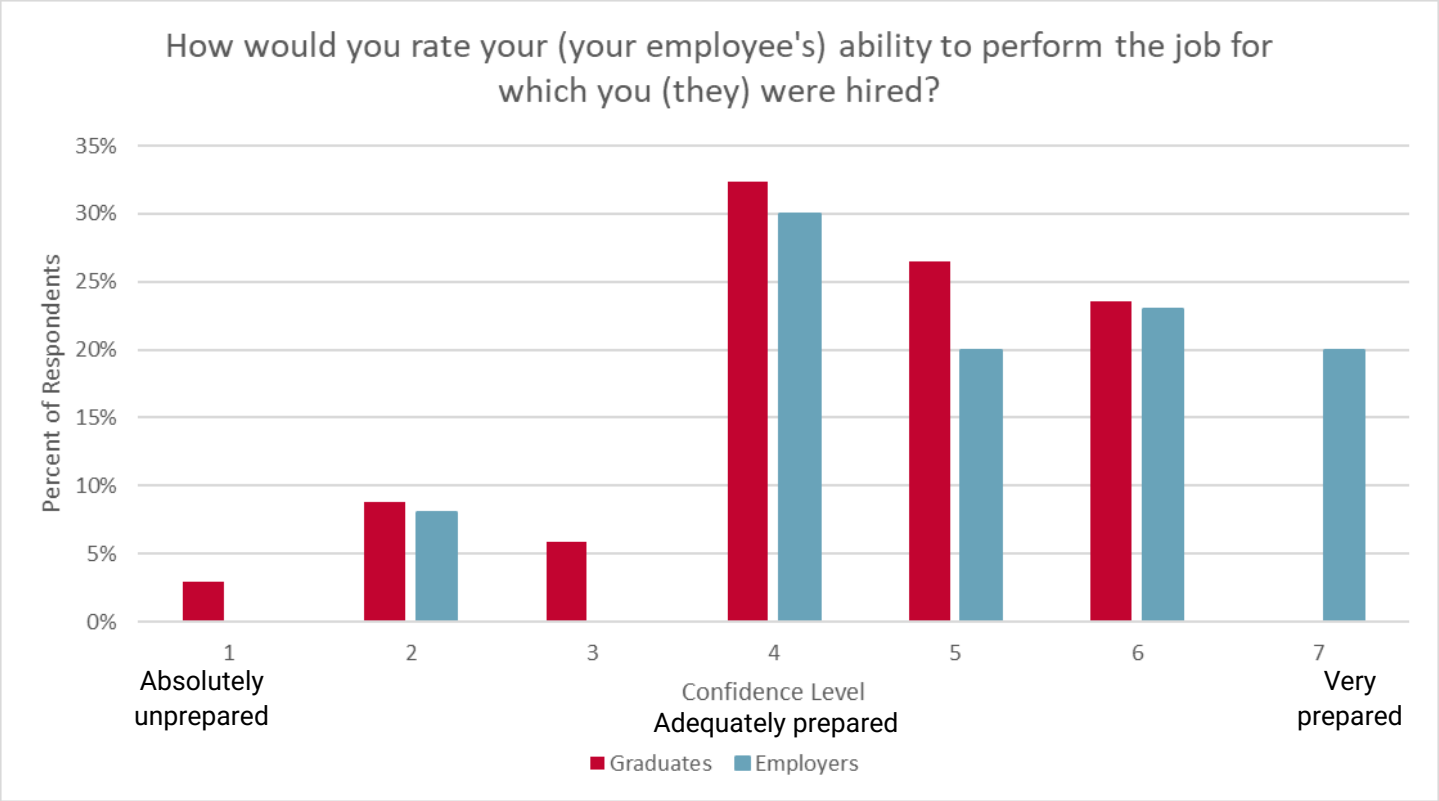
Readiness for Employment Upon Graduation

Graduates and employers rated the graduates' overall preparation for their first job using the following 7-point scale:

- 1 – Absolutely unprepared
- 4 – Adequately prepared
- 7 – Very prepared

Figure 4.1 demonstrates how graduates and employers rate the graduates' overall preparation to perform their first job. The majority of graduates feel that they are adequately prepared, while the majority of employers believe the graduates are much closer to very prepared.

Figure 4.1: Preparation to Perform First Job According to Graduates (N=34) and Employers (N=40)



Finally, Table 4.6 illustrates the employment location of the graduates in the OVC 2021 cohort. Responses in this table were based on the Graduate Survey data, as well as a number of searches, including the CVO "Find a Veterinarian" database, Google, Facebook, and LinkedIn. One hundred and two of the 120 graduates were located (85%). Eighty new graduates were employed in Ontario (78% of those responding).

Table 4.6: Employment Location for New Graduates (OVC 2021) (N=102)

Employment Location	Number of Graduates (%)
Central East - Ontario	6 (6%)
Central West – Ontario	29 (28%)
Central South – Ontario	9 (9%)
East – Ontario	6 (6%)
North – Ontario	4 (4%)
South West – Ontario	14 (14%)
Toronto - Ontario	12 (12%)
Canada - Not Ontario	12 (12%)
United States	8 (8%)
Other Country (Australia, United Kingdom)	2 (2%)

Feedback Provided in Comments from Students

Strengths of the Program

Twenty-five students provided written feedback about the strengths of the DVM program at the Ontario Veterinary College. Several students listed more than one strength. Qualitative comments were coded and the most commonly occurring of these are listed below, with quotations to illustrate each theme.

Rotations Provided Excellent Opportunities for Learning

Eight survey respondents commented that the Phase 4 rotations provided excellent opportunities for learning. Some respondents mentioned that the opportunity to engage in elective rotations that fit their career interests is a strength of the program. Other commenters indicated that many rotations offered hands-on learning opportunities.

- "Excellent opportunities, through extracurriculars, streaming options, and rotation electives to tailor the final year towards one's professional career interest."
- "Majority of the 4th year rotations are organized very well and that's the year I learned the most."

Primary Healthcare Centre

Six respondents commented that their learning experiences at the Primary Healthcare Centre (PHC) provided meaningful learning opportunities.

- "Involving students in the primary healthcare centre in meaningful ways (not just nutrition assignments). This building, the team are an amazing contribution to the curriculum and gave me so many more skills I can apply to the real world of practice than all my time in internal medicine/surgery/the companion animal hospital did."

Didactic Teaching

Six respondents indicated that OVC does a good job of teaching veterinary knowledge through didactic teaching.

- "Didactic teaching is well done but can be combined with more hands-on experiences."

Other Strengths

Other strengths of the DVM program listed by survey respondents included: the surgical skills curriculum (listed by four respondents), the teaching of pathology (listed by three respondents), the communications skills curriculum (listed by three respondents), and the exposure to real-life cases (listed by three respondents).

Recommendations to Improve the DVM Program

Twenty-eight students provided recommendations to improve the DVM program at the Ontario Veterinary College. Some students provided more than one suggestion. Qualitative comments were coded and the most commonly occurring are listed below, with quotations to illustrate each theme.

Increase Focus on Practical Everyday Skills and Reduce Focus on Specialized Skills

Most suggestions focused on graduates' perceptions of a need for an increased focus on skills that are used in general practice, such as dentistry (N=9) or dermatology (N=6) and a reduced focus on specialized skills. Students also requested more hands-on opportunities to practice clinical and surgery skills (*N*=10).

- "Focus more on teaching the practical things that more general practitioners do on a daily basis - general exams, vaccines, dentals, routine surgeries (neuters, spays)."
- "Dentistry, derm, general practice problem solving techniques"

Increase Use of Case Examples and Case-Based Learning

Seven students requested more use of case-based learning to help them practice working through cases from start to finish.

- "Spend more time on case-based learning, interpretation of findings and how to make a plan and treating the common things."
- "In general, I think that more application based learning and testing would be beneficial to simulate the real world."

Feedback Provided in Comments from Employers

Strengths of the Program

Twenty-eight employers described strengths of OVC's DVM program. Several employers listed more than one strength. Qualitative responses were coded and the most commonly occurring themes are listed below.

Effective Instruction of Client Communication Skills

Eleven employers described the teaching of client communication skills as a strength of the OVC program. Employers described OVC graduates as skilled communicators who interact professionally with clients and other professionals.

- "Students graduate well prepared to speak with clients and work up the cases."

Strong Teaching of Medical Knowledge

Eight employers indicated that OVC students graduate with a strong background in medical knowledge.

- "The depth and breadth of knowledge imparted that we see in our new grad is remarkable. I would credit the teaching style and curriculum at OVC."
- "I'm very pleased with internal medicine knowledge level and student's critical thinking."

Recommendations to Improve the Program

Thirty-four employers provided recommendations to improve the program. Some respondents offered more than one recommendation. Qualitative responses were coded and the most commonly occurring themes are listed below.

Need for Increased Dentistry Curriculum

Nine employers suggested that the OVC curriculum could benefit from increased dentistry instruction.

- "OVC should really increase the amount of dental training the students get. Dental health is a huge topic discussed with clients but we find new grads lack in doing dental x-rays, extractions and in hiring them we are unable to keep with the amount of pets who need a procedure."

Need for Increased Teaching of Time Management and Other Non-Clinical Skills

Nine employers indicated that OVC graduates need more training related to time management, efficiency, and other similar non-clinical skills.

- "Efficiency and time management seem to be severely lacking in this group of students."
- "Time management and a more reasonable approach to the fears of professional misconduct."

4.4.1.2 Results of Alumni Survey

Thirty of the 120 graduates responded to some or all of the survey questions in the Alumni Survey of OVC 2017, representing a 25% response rate. Table 4.7 displays the type of practice in which alumni were first

employed after graduation. Respondents could choose more than one response category, so the percentages sum to more than 100%. Seventeen of the responding graduates were employed in equine, food animal or rural community/mixed practices.

Table 4.7: Type of Practice from the Alumni Survey (OVC 2017) – First Position After Graduation (N=30)

Practice Category	Practice Type	Number of Respondents (%)
Clinical Practice	Equine	5 (17%)
Clinical Practice	Food Animal	7 (23%)
Clinical Practice	Rural Community Practice/Mixed	5 (17%)
Clinical Practice	Small Animal	21 (70%)
Clinical Practice	Other Private Clinical Practice	2 (7%)
Non-Clinical Practice	Graduate School	0 (0%)
Non-Clinical Practice	Government	1 (3%)
Non-Clinical Practice	Not-for-Profit Clinical	0 (0%)

Feedback Provided in Comments from Alumni

Seventeen alumni provided recommendations to improve the DVM program at the Ontario Veterinary College. These suggestions largely echoed the comments from the Graduate Survey. Qualitative comments were coded and the most commonly occurring are listed below, with quotations to illustrate each theme.

Increase Focus on General Practice Skills and Reduce Focus on Referral Procedures

The most commonly occurring feedback was the suggestion to increase the focus on skills required in general practice and reduce the focus on referral or speciality procedures. Specific skills mentioned included dentistry (N=5) and dermatology (N=3).

- "I wish there had been a greater emphasis on practical considerations/uses of antimicrobials (including products and doses), more emphasis on treatment options and how to apply those practically, and a greater emphasis on business and mentorship."
- "It would be good to have more hands on experience and focus on cases that are more commonly seen rather than sometimes focusing on small details."

Change Assessment Strategies

Three alumni suggested that OVC could change the frequent use of multiple-choice testing and memorization in assessment and incorporate more case-based learning and problem-solving.

- "Classical memorization and testing for a knowledge base is important but we need to make new connections by actively using our knowledge in a clinical setting."

Increase Focus on Student Mental Health

Three alumni suggested that OVC could increase the focus on mental health and work-life balance for students as these issues are persistent problems in the profession.

- "Please continue to focus on mental health, burnout, what it is, tools to help people identify when they are experiencing it, maybe even a buddy system to ensure people check in with one another on a regular interval when they are in practice."

4.4.2 Curricular Requirements (Years 1 to 3) and Examples of Co-Curricular Opportunities

The DVM curriculum is managed by the OVC Curriculum Committee and addresses changes to the program in an evolving, on-going basis with input from external stakeholders (including OMAFRA), students, and faculty.

4.4.2.1 DVM Program Core Curricular information

Phase 1:

Health Management I

The overall goal of this course is to present the students with an integrated approach to the disciplines of medicine, epidemiology, ethology, public health, and animal husbandry. This course will also provide the foundation for more in-depth coverage of these topics in subsequent courses (Phase 2-Health Management II and Phase 3-Health Management III).

Clinical Medicine I

The Clinical Medicine courses presented in Phases 1, 2 and 3 represent a continuum of learning intended to foster student mastery of seven main learning outcomes by the end of Phase 3 of the DVM program: animal handling and restraint, history taking, physical examination of common domestic species, diagnosis, clinical problem solving, treatment and planning, medical records.

Phase 2:

Health Management II

Emphasis will be placed on relevant epidemiological tools for understanding disease causation, evidence-based medicine and critical appraisal of the literature, surveillance, and outbreak investigation. Animal behaviour, and animal welfare issues, will be presented in a species/ industry context. The public health section will focus on regulatory matters, food safety, and zoonotic disease issues.

Clinical Medicine II

The course is a continuation of Clinical Medicine I. It will contribute to students' achievement of selected elements of graduating competency in the areas of clinical examination of specific organ systems of various species.

Theriogenology

A lecture and laboratory course covering the normal and abnormal reproductive systems of domestic animals. The course will include mammalian reproductive physiology and histology, diagnosis and treatment of reproductive disorders, including infertility, and management of breeding programs of the common domestic species.

Phase 3:

Health Management III

The course will contribute to students' achievement of greater depth in the context of health management in species of their choice. The primary emphasis is directed towards developing species-specific skills, knowledge and attitudes that will permit the entry-level veterinarian to assess and advise on animal production and performance and evaluate the necessity for, and implementation of, health management programs. The

course is a series of species-based modules including beef, companion animals, dairy, equine, laboratory animals, poultry, small ruminants, swine, and wildlife.

Clinical Medicine III

The overall objective of Clinical Medicine III is to facilitate the integration of course material from all phases into a practical approach to case evaluation.

Food Animal Medicine and Surgery

The goal of this course is to introduce the student to the diagnosis and management of common diseases (and the recognition of uncommon diseases) of ruminants and swine.

Equine Medicine and Surgery

The goal of this course is to introduce the student to the diagnosis & management of common diseases (and the recognition of uncommon diseases) of horses.

Comparative Medicine

This course will cover strategies to deal with common and uncommon diagnoses in the context of pet birds, commercial poultry, and non-traditional species (fish, amphibians, reptiles, rabbits, rodents, ferrets, non-domestic carnivores and non-domestic ungulates).

4.4.2.2 DVM Co-Curricular Opportunities

Examples of DVM co-curricular opportunities provided through the OVC Food Animal Club include:

- Small Ruminant reproduction (seminar);
- Lambing assisting (supervised on-farm experience);
- Poultry euthanasia (wet lab);
- Calf disbudding (supervised on-farm experience);
- Perinatal care of beef calves (seminar); and
- Swine pregnancy exams and back fat ultrasounds (wet lab).

4.4.3 Curricular Requirements (Year 4)

Phase 4:

The stream counts for the OVC 2022 cohort are shown in Table 4.8. 29% of students are involved in the food animal, rural community practice, and equine streams. Table 4.9 provides the number of students involved in those streams over the term of the Agreement. The number has remained relatively stable over the last four years.

Table 4.8: Stream Counts for the OVC 2022 Cohort

Stream	Number of Students	Percentage of Students
Food Animal	11	9%
Rural Community Practice	16	13%
Equine	8	7%
Small Animal	86	71%
Total	**121**	

Table 4.9: Number of Students involved in the Food Animal, Rural Community Practice, and Equine Streams over the Term of the Agreement

Number of Students in the Food Animal, Rural Community Practice and Equine Streams	37	37	36		

The curricular requirements for the streams relevant to VCP are presented below.

Food Animal Stream

Students in the Food Animal Stream will have the following rotations:

Core:

- Veterinary Externship (8 weeks)
- NAVLE Study Week (1 week)
- Anatomic Pathology (1 week)
- Diagnostic Pathology & Laboratory Medicine (1 week)
- Small-Animal Primary Veterinary Care (3 weeks)
- Theriogenology (1 week)
- Ruminant Health Management I (2 weeks)
- Swine Health Management (2 weeks)
- Approved External Practices, Food Animal (6 external weeks)

Stream-Priority: (4 of the following 10 rotations)

- Dairy Cattle Welfare (1 week)
- Heartland Dairy Practice (1 week, external)
- Poultry Health (2 weeks)
- Ruminant Health Management II, Beef (2 weeks)
- Ruminant Health Management II, Small Ruminants (1 week)
- Ruminant Health Management II, Dairy (2 weeks)
- Ruminant Health Management III, Dairy Nutrition (1 week)
- Ruminant Health Management III, Dairy-Herd Problem Solving (2 weeks)
- Ruminant Surgery (2 weeks)
- Swine Health Management, Production (1 week)

Electives:

- Variable (internal or external rotations)[23] (4-8 weeks)

Total = 38 weeks

[23] External rotations for DVM 2021 graduates were delayed from May to August 2020 due to the pandemic.

Rural Community Practice Stream

Students in the Rural Stream will have the following rotations:

Core:

- Veterinary Externship (8 weeks)
- NAVLE Study Week (1 week)
- Anatomic Pathology (1 week)
- Diagnostic Pathology & Laboratory Medicine (1 week)
- Small-Animal Primary Veterinary Care (3 weeks)
- Theriogenology (1 week)
- Anesthesia (2 weeks)
- Radiology (2 weeks)
- Small-Animal Internal Medicine (2 weeks)
- Large-Animal Medicine (2 weeks)
- Ruminant Health Management I (2 weeks)
- Swine Health Management (1 week)
- Approved External Practices, Rural mixed species (4 external weeks)

Electives:

- Variable (internal or external rotations) (8 weeks)

Total = 38 weeks

Equine Stream

Students in the Equine Stream will have the following rotations:

Core:

- Veterinary Externship (8 weeks)
- NAVLE Study Week (1 week)
- Anatomic Pathology (1 week)
- Diagnostic Pathology & Laboratory Medicine (1 week)
- Small-Animal Primary Veterinary Care (3 weeks)
- Theriogenology (1 week)
- Anesthesia (2 weeks)
- Radiology (2 weeks)
- Neurology (1 week)
- Large-Animal Medicine I (2 weeks)
- Large-Animal Surgery I (2 weeks)
- Large-Animal Medicine II or Large-Animal Surgery II (2 weeks)

Stream-Priority: (2-3 of the following 3 rotations)

- Equine Anesthesia & Surgery (1 week)

- Equine Lameness (2 weeks)
- Equine Primary Care (1 week)

Electives:

- Variable (internal or external rotations) (8-10 weeks)

Total = 38 weeks

4.4.4 Faculty and Staff Capacity

Table 4.10 shows the key faculty and veterinarian positions in the Ontario Veterinary College contributing to the Veterinary Capacity Program.

Table 4.10: Faculty and Veterinarians in OVC contributing to the Veterinary Capacity Program

Name	Rank and Department	Specialty
Arroyo, Luis	Associate Professor, Clinical Studies	Large Animal Medicine
Barta, John	Professor, Pathobiology	Parasitology
Bauman, Cathy	Assistant Professor, Population Medicine	Epidemiology and Applied Clinical Research
Beeler-Marfisi, Janet	Assistant Professor, Pathobiology	Clinical Pathology
Bienzle, Dorothee	Professor, Pathobiology	Clinical Pathology
Boerlin, Patrick	Associate Professor, Pathobiology	Bacteriology
Bridle, Byram	Associate Professor, Pathobiology	Anatomic Pathology
Caswell, Jeffrey	Professor, Pathobiology	Anatomic Pathology
Chenier, Tracey	Associate Professor, Population Medicine	Theriogenology
Clow, Katie	Assistant Professor, Population Medicine	One Health
Cote, Nathalie	Assistant Professor, Clinical Studies	Large Animal Surgery
Deckert, Anne	Veterinarian, Health Sciences Centre	Veterinarian. DOE does not apply.
Dubois, Marie-Soleil	Assistant Professor, Clinical Studies	Large Animal Surgery
Duffield, Todd	Professor, Population Medicine	Ruminant Health Management
Foster, Robert	Professor, Pathobiology	Anatomic Pathology
Friendship, Robert	Professor, Population Medicine	Swine Health Management
Gomez-Nieto, Diego	Assistant Professor, Clinical Studies	Large Animal Medicine
Gordon, Jessica	Assistant Professor, Population Medicine	Ruminant Health Management
Grant, Lauren	Assistant Professor, Population Medicine	Public Health
Guerin, Michele	Associate Professor, Population Medicine	Epidemiology
Haley, Derek	Associate Professor, Population Medicine	Animal Welfare
Hewson, Joanne	Associate Professor, Clinical Studies	Large Animal Medicine
Jardine, Claire	Associate Professor, Pathobiology	Comparative Pathology

Name	Rank and Department	Specialty
Johnson, Ronald	Associate Professor, Biomedical Sciences	Pharmacology/Toxicology
Kelton, David	Professor, Population Medicine	Epidemiology
Kenney, Daniel	Veterinarian, Health Sciences Centre	Veterinarian. DOE does not apply
Koch, Thomas G.	Associate Professor, Biomedical Sciences	Cellular/Molecular Biology
Koenig, Judith	Associate Professor, Clinical Studies	Large Animal Surgery
Lack, Amy	Assistant Professor, Clinical Studies	Large Animal Medicine
LeBlanc, Stephen	Professor, Population Medicine	Ruminant Health Management
Lillie, Brandon	Associate Professor, Pathobiology	Anatomic Pathology
Lumsden, John	Professor, Pathobiology	Anatomic Pathology
Maboni, Grazieli	Assistant Professor, Pathobiology	Veterinary Virology and Clinical Microbiology
Madan, Pavneesh	Associate Professor, Biomedical Sciences	Reproductive Biology
Mallard, Bonnie	Professor, Pathobiology	Immunology
Murphy, Heather	Associate Professor, Pathobiology	One Health
Nykamp, Stephanie	Professor, Clinical Studies	Radiology
O'Sullivan, Terri	Associate Professor, Population Medicine	Swine Health Management
Papadopoulos, Andrew	Associate Professor, Population Medicine	Public Health (incl. CPHAZ)
Parmley, Elizabeth	Associate Professor, Population Medicine	One Health
Peregrine, Andrew	Associate Professor, Pathobiology	Parasitology
Poljak, Zvonimir	Associate Professor, Population Medicine	Public Health (incl. CPHAZ)
Rau, Jeffrey Allen	Veterinarian, Health Sciences Centre	Veterinarian
Renaud, David	Assistant Professor, Population Medicine	Ruminant Health Management
Ricker, Nicole	Assistant Professor, Pathobiology	Pathogenomics and Disease Informatics
Sargeant, Janice	Professor, Population Medicine	Public Health (incl. CPHAZ)
Schott, Courtney	Assistant Professor, Pathobiology	Anatomic Pathology
Sharif, Shayan	Professor, Pathobiology	Immunology
Spence, Kelsey	Assistant Professor, Population Medicine	Epidemiology and One Health
Susta, Leonardo	Assistant Professor, Pathobiology	Avian Virology
Valverde, Alexander	Professor, Clinical Studies	Anesthesiology
Weese, Jeffrey Scott	Professor, Pathobiology	Public Health (incl. CPHAZ)
Winder, Charlotte	Assistant Professor, Population Medicine	Ruminant Health Management
Wood, Geoffrey	Associate Professor, Pathobiology	Anatomic Pathology
Wood, Robert Darren	Associate Professor, Pathobiology	Anatomic Pathology
zur Linden, Alex	Associate Professor, Clinical Studies	Radiology

In addition to the faculty and veterinarians, there are a number of support staff who contribute to VCP through their appointments in the Health Sciences Centre. These include:

- 17.9 FTEs in Large Animal Veterinary Technicians; and
- 8 FTEs in Large Animal Agricultural Assistants.

These total 25.9 FTEs, which is approximately 16% of all Health Sciences Centre staff.

5 ANIMAL HEALTH LABORATORY

The Animal Health Laboratory (AHL) has demonstrated capabilities and capacities (expertise, diagnostic testing and analysis, test development, surveillance data, information, and resources) to be prepared for and respond to animal disease outbreaks.

AHL is a long-standing program under the Agreement that continues to evolve, providing high-value analytical and diagnostic services and animal health expertise to local communities, industry, Canadian universities, and provincial and federal government organizations. Further to the transformation of the Veterinary Laboratory Services Branch of OMAFRA into the Animal Health Laboratory within the Laboratory Services Division (LSD), Office of Research, AHL continues to serve Ontario as the provincial veterinary reference laboratory and to act as a central source for provincial animal disease trend information and timely dissemination of knowledge to veterinarians, producers, and industry groups.

5.1 Program Activities and Achievements from 2021/22

The AHL diagnostic system provides valuable and timely information that enables Ontario to remain competitive in national and international trade. Through accessions from veterinarians, AHL delivers data on new and emerging diseases affecting the health of livestock, poultry, and the public across the province. Many diseases are first recognized in Ontario through postmortem examinations and ancillary testing carried out by AHL at the Guelph and Kemptville locations. Because of the laboratory infrastructure and expertise needed to detect disease hazards, AHL provides an efficient and effective early warning system for a wide variety of diseases.

AHL sent 52 samples to the Canadian Food Inspection Agency (CFIA) for confirmatory testing in suspect cases of reportable diseases, namely Avian Influenza, Bluetongue, Bovine cysticercosis, *Mycobacterium* spp. (Bovine tuberculosis), Epizootic Hemorrhagic Disease, Influenza, Newcastle Disease Virus (Avian paramyxovirus), Rabbit hemorrhagic disease virus, and Rabies.

AHL plays an important role in public health by identifying pathogens common to animals and people. Over 1,250 cases that identified zoonotic pathogens were diagnosed by AHL in 2021/22.

AHL received approximately 113 medicolegal cases, including several from the Ontario Ministry of the Solicitor General under the new 2019 Provincial Animal Welfare Services (PAWS) Act, as part of investigations into animal neglect and abuse. AHL also performed 38 equine postmortems submitted by the Alcohol and Gaming Commission of Ontario (formerly the Ontario Racing Commission). Through testing at AHL, AGCO can assure Ontarians participating in the horse racing industry that it is closely scrutinized, and that animal welfare is a priority.

AHL monitors trends in existing diseases and sends electronic real-time alerts to OMAFRA, enabling the Ministry to respond rapidly and efficiently to health threats to the livestock and poultry industries. By providing information on disease trends, policy or decision makers have information readily available to perform risk assessments, evaluate control strategies, identify research needs, and facilitate planning.

The Animal Health Laboratory has focused on several important program activities during 2021/22. These included: maintaining full operational capacity during the COVID-19 pandemic in order to meet client testing requirements; increasing surge capacity in the event of an African Swine Fever (ASF) disease outbreak; and responding to the Spring 2022 Avian Influenza (AI) outbreak in Ontario. During the Omicron wave of the COVID-19 pandemic from January-April 2022, significant staffing shortages were experienced. Because of cross-

training and the dedication of laboratory staff, AHL was able to reorganize and ensure that fast turnaround times for critical client cases were maintained.

Emergency Response

The potential incursion of ASF continues to be a threat to the swine sector in Ontario. To increase PCR surge testing capacity, four additional thermocyclers were purchased and structural modifications to the laboratory were made to accommodate a second dedicated thermocycler suite. As well, four additional analysts were trained and certified for ASF testing, and OMAFRA provided $25,000 for the purchase of a stockpile of ASF testing reagents. Not only do these acquisitions and actions position AHL to respond successfully to the threat of an ASF outbreak, they also support business continuity for other livestock sectors submitting samples for testing at AHL. Maintenance of business continuity was exemplified during the AI outbreak in Ontario which began in March 2022. Even prior to this declaration, AHL was working in the background with CFIA to update AHL's AI Emergency Response Plan and test the communication networks. These actions ensured a seamless response when AHL was asked by CFIA to test samples for AI. Throughout the outbreak, AHL staff worked evenings and weekends to ensure that test results were reported in a timely manner, typically within five hours of submission, thus ensuring rapid response for the commercial poultry farms relying upon results for movement of products to market.

Laboratory Information Management System

Ongoing upgrades to the Laboratory Information Management System (LIMS) and the information technology infrastructure ensure the utility and protection of data used for surveillance purposes. Examples include: 1) increasing the level of security on client reports preventing data from being copied from reports except where approved by the AHL Director; 2) encrypting workstations and laptops to meet campus compliance requirements; 3) increasing the client sample ID field to accommodate clients with longer sample IDs and reducing data entry errors; and 4) creating a sequencing module and methodology for reporting sequencing results to allow for easier data mining of results.

Large volume clients, such as the amalgamated swine veterinary clinics, have requested a greater ability to access their clients' data, as data mining and trending have become important tools for this population-based livestock sector. Therefore, a large-scale LIMS data management project (funded by a Food from Thought Digital Agriculture grant), improvements to the client portal, and a smartphone application are enhancement projects that are in progress and are expected to be rolled out in 2022/23. The development of AHL's Interactive Animal Pathogen Dashboards (IAPDs) is expected to provide near real-time disease surveillance information that will serve producers, veterinarians, livestock industries, and animal health regulatory agencies in the bovine, poultry, and swine sectors.

Novel Technologies

AHL specialists continue to advance their expertise in novel technologies in order to ensure that AHL remains at the forefront of animal disease testing. The next generation of Whole Genome Sequencing (WGS), utilizing the Illumina MiSeq, is one of these revolutionary technologies, and all three AHL microbiologists (Drs. Ojkic, Slavic, and Cai) have projects underway that provide training opportunities for technical staff and interactions with international colleagues that position AHL to translate this platform, as it matures, into the diagnostic testing program. These projects include: 1) routine WGS of *E. coli*, *Staphylococcus pseudintermedius* and *Salmonella* spp. isolates for the Veterinary Laboratory Investigation and Response Network (Vet-LIRN-USDA); 2) WGS of viral pathogens carried by Varroa mites in bees; and 3) investigation of recombination events between field (and vaccine) viruses in clinical samples that may generate new variants, e.g., infectious bronchitis virus (field and vaccine strains) and fowl adenovirus (field strains). These projects will position AHL at the leading edge of revolutionary diagnostic test platforms in the future.

Provide Animal Health Expertise

AHL veterinarians/supervisors participated in a host of regional, provincial, and national veterinary organizations to provide animal health expertise. In addition, AHL veterinarians/supervisors also produce a significant number of KTT publications, outlined in Section 5.4.7.

This expertise and knowledgebase are used to alert OMAFRA about any potential health threats. Any occurrence of one of the 120 immediately notifiable diseases named in the provincial Animal Health Act, 2009, is reported to the Office of the Chief Veterinarian for Ontario (OCVO) electronically at 0900 and 1500 hours daily. Tables 5.1 and 5.2 below illustrate the immediately notifiable reportable and alertable hazards tests performed in 2021/22. New and emerging hazards are tabulated annually in an Impact Table, as provided in Table 5.3, and are reported in the quarterly AHL Newsletter. Disease trends are also discussed in detail at each of the Ontario Animal Health Network (OAHN) expert network quarterly calls.

Table 5.1: Immediately Notifiable Hazards – Reportable Disease Tests Completed 2021/22

Reportable Disease Tests	Tests Completed
African Swine Fever-PCR/CFIA	112
Avian Influenza CFIA	8
Avian Paramyxovirus-1 fusion rt-RT-PCR/CFIA Newcastle Disease	4
Avian Paramyxovirus-1 matrix rt-RT-PCR	82
Bovine cysticercosis- CFIA	1
Mycobacterium spp. - CFIA	4
Rabbit Hemorrhagic Disease Virus - CFIA	1
Classical Swine Fever Virus rt-RT-PCR	1
Epizoonotic hemorrhagic Disease rt-RT-PCR	11
Fish Infectious Pancreatic Necrosis Virus	5
Infectious Hematopoietic Necrosis Virus qPCR	5
Infectious salmon anemia virus - PCR	5
Influenza CFIA	1
Influenza A, H5 PCR	63
Influenza A, H7 PCR	63
Rabies, CFIA – FA	22
Small Hive Beetle PCR	13

Table 5.2: Immediately Notifiable Hazards – Notifiable Alerts 2021/22

Notifiable Tests Completed	Notifiable Alerts
Avian Influenza CFIA	5
Avian Paramyxovirus-1 fusion rt-RT-PCR	4
Avian Paramyxovirus-1 matrix rt-RT-PCR	4
Mycobacterium spp. - CFIA	3
Small Hive Beetle PCR	9
Porcine epidemic diarrhea virus PCR	77
Transmissible gastroenteritis PCR	1
Porcine deltacoronavirus PCR	44
Avian encephalomyelitis virus rt-RT-PCR	2
Avian encephalomyelitis pathology	2
Avian Herpesvirus type 1/ILT	8
ILTV PCR	1
Infectious larynogotracheitis virus rt-RT-PCR	11
Brucella canis – IFA	3
Cache Valley virus pathology	9

Notifiable Tests Completed	Notifiable Alerts
Clostridium botulium pathology	1
Coxiella burnetii ELISA	20
Coxiella burnetii RT-PCR	35
Coxiella burnetii pathology diagnosis	15
Ecoli, VTEC (verotoxigenic), typing	2
Eastern Equine Encephalitis virus rt-RT-PCR	2
Eastern Equine Encephalitis virus pathology	1
Epizootic Hemorrhagic Disease virus PCR/CFIA	2
Equine respiratory RT-PCR panel w/ culture	1
Equid herpesvirus 1 Neuropathogenic PCR	6
Equid herpesvirus 1 Non-neuropathogenic PCR	16
Equine encephomyelitis virus, Eastern - IgM ELISA	5
Fish VHS virus PCR	2
HSFP, envirnomental culture	38
HSFP, reactor	1
IHC - Listeria, Food animal	4
Listeria Monocytogenes pathology	17
Listeria isolation	4
Influenza A, H5 PCR	55
Influenza – CFIA	1
Influenza A MultiS ELISA	9
Influenza A virus H1	35
Influenza A virus H1 alpha	23
Influenza A virus H1 beta	25
Influenza A virus H1 pandemic	11
Influenza A virus H3	39
Influenza A virus N1	33
Influenza A virus N1 pandemic	10
Influenza A virus N2	85
Influenza A, matrix PCR	110
Lead, blood	20
Mineral Panel, heavy metal screen	19
Rabies CFIA – FA	4
Salmonella dublin ELISA	3
Salmonella dublin Ab ELISA	66
Salmonella Enteritidis-PCR	7
Salmonella Pullorum-typhoid microagglutination	14
Salmonella serotyping	683
Salmonella spp. PCR	6
Salmonella surveillance	2
Senecavirus – PCR	1
IHC-West Nile virus, polyclonal antibody	2
West Nile virus - IgM ELISA - NVSL Ames	3
West Nile virus rt-RT-PCR	15

Table 5.3: Impact Table 2021/22

Date Identified	Species or Commodity	Disease, Hazard, or Pathogen	AHL/Clinical Finding	Impact on Animal Health, Public Health, and/or Trade
Every year	All species	**New, emerging, and re-emerging zoonotic pathogens and hazards**	Annual summary of approximately 26 diseases or pathogens; more than 1,000 events per year.	Selected zoonotic pathogens and diseases from Ontario identified at the AHL – Rossi et al; Reported in the March issue of the AHL Newsletter every year.
2022, April	Bovine	**Manganese deficiency (suspected)**	Owner reports pulled calf this morning, calf was backwards, limbs and head deformed similarly to previous submission. Second case is malformed calf born April 4/22. Dam is a heifer, full term pregnancy due to A.I. – breeding.	**22-028603** – SO and **22-27421** – ML. These malformed stillborn calves were submitted under the OAHN bovine project "Trace mineral monitoring in beef cattle herds". All tests for common viral pathogens and Cache Valley virus were negative. Results of referral to CFIA for Schmallenberg testing are pending. Calf tissue mineral levels indicate low normal manganese, suspicious but not conclusive of manganese deficiency as the cause of chondrodysplasia and malformation. Additional work is required to confirm normal level of manganese in bovine fetuses and newborn calves.
2022, March	Porcine	***Leptospira* Pomona**	At meat inspection, several finisher hog carcasses had kidneys 90% affected by flat white, coalescing, fairly well-demarcated foci (0.5-1.0 cm) throughout; renal lymph nodes large in all animals.	**22-013690** – MS and DO. Lymphoplasmacytic interstitial nephritis with suppurative tubulonephritis and pyelonephritis - *Leptospira* Pomona identified by PCR. This case resulted in a new PCR test developed at AHL in order to identify the serotype of Leptospira involved in causing this uncommon meat inspection finding. AHL Newsletter article published June 2022; Vol 26(2):12-13.
2022, February	Bison	***Erysipelothrix rhusiopathiae***	Herd of 54 bison purchased in July from drought area, four dead. PM – severe bronchopneumonia with aseous abscesses throughout right lung. Herd is VERY thin, BCS 1.5/5. Dewormed twice with Safeguard before arrival.	**21-103344** – RE and DS. Unilateral bronchopneumonia with abscessation - *Pasteurella multocida;* embolic hepatitis - *Pasteurella multocida* & *Eryipelothrix rhusiopathiae*. Significant mortality event in alternative species group. *E. rhusiopathieae* is a reported cause of mortality in muskox and bison, causes infections in a variety of domestic and wild species, and is considered a potentially zoonotic infection.
2021,	Canine	***Brucella canis***	Five month history of	**21-091271** – DS. Blood culture submitted - *Brucella canis*

Date Identified	Species or Commodity	Disease, Hazard, or Pathogen	AHL/Clinical Finding	Impact on Animal Health, Public Health, and/or Trade
November			intermittent neck pain. MRI consistent with discospondylitis. Dog adopted from Mexico.	isolated from enrichment. *B. canis* is a re-emerging pathogen of dogs, most often isolated from rescue animals and those in congregate housing. It represents a significant zoonotic risk.
2021, October	Cervid, White-Tailed Deer	**Epizootic hemorrhagic disease**	Lung and spleen samples submitted from white-tailed deer for EHDV/BTV PCR.	**21-086645** and **21-090741** – DO and JF. Epizootic hemorrhagic disease virus (EHDV) PCR positive. EHDV is a vector-borne viral infection of wild cervids with rare spillover in domestic cattle and sheep. It is very similar to, and must be differentiated from, bluetongue which is a more significant pathogen of cattle and sheep that is also spreading north due to climate change.
2021, September	Porcine	***Septicemia – Strep equi ssp zooepidemicus***	Organic herd – lost 69 pigs from group of 500 in last 72 hrs. Affected pigs and dead pigs showed evidence of septicemia. History of *Strep zooepidemicus* in herd.	**21-075433** – MS and DS. High mortality due to septicemia caused by *Streptococcus equi ssp zooepidemicus,* POSITIVE for SzM virulence factor gene. This highly pathogenic strain of *Strep. zooepidemicus* has recently emerged as a high consequence pathogen in swine. This is the second outbreak on the only farm in Ontario from which this bacterial strain has been isolated.
2021, July	Porcine	**Glasser's disease**	A boar stud with co-mingled groups from multiple sources reported 19 sick animals, one dead and three more euthanized due to massive swelling of testes.	**21-055982** – AM. This unusual presentation of fibrinous polyserositis with severe periorchitis caused by *Glaesserella parasuis* (Glasser's disease) was attributed to introduction of naïve animals into group housing. Orchitis/periorchitis is an uncommon pathologic finding in boars that has to be differentiated from foreign etiologies such as *Brucella suis.* AHL Newsletter article published Sept. 2021; Vol 25(3):14-15.
2021, July	Ovine	***Monensin toxicosis***	Sudden death of four lambs on Sunday morning. Postmortems on farm noted large volume abdominal and pleural effusions. Ewes were receiving monensin in a mineral supplement, either top-dressed	**21-060479** – MS. Multifocal acute myocardial necrosis with acute periacinar hepatic necrosis due to Monensin toxicosis. This common feed supplement can cause significant mortality events if fed to young ruminants, or if accidentally included in swine, poultry, or equine feed.

Date Identified	Species or Commodity	Disease, Hazard, or Pathogen	AHL/Clinical Finding	Impact on Animal Health, Public Health, and/or Trade
			or in TMR.	
2021, July	Bovine	***Neospora caninum* abortions**	Multiple cases ongoing in a tie stall barn, closed herd. Vaccinate annually with Triangle 10 and Covaxin.	**21-060789**, **21-060791, 21-057615**, **21-058712, 21-060317** – SOS and JF. Abortion storm in Holstein herd confirmed to be caused by *Neospora caninum* infection.

Conduct Testing and Analysis

The Animal Health Laboratory accessioned 77,440 cases and performed 748,350 procedures in 2021/22 in support of disease surveillance. Compliance with published turnaround times from the AHL Laboratory Information Management Systems was 96.55%. Standards Council of Canada scope of accreditation was changed in April 2022 to a new version. Testing equipment in AHL's inventory was replaced in 2021/22 to improve efficiency and surge capacity of the lab. In addition, AHL developed or improved 16 tests in 2021/22.

Early Detection and Effective Response to Foreign Animal Diseases and/or other Diseases with Human/Animal Health and Economic Consequences

Three representative AHL pathology cases were submitted to OMAFRA for comment in order to monitor timeliness of testing, resulting, and communications. Where available, OMAFRA comments are included in italics. These three cases are included in Appendix C.

5.2 Mandatory Compliance Requirements

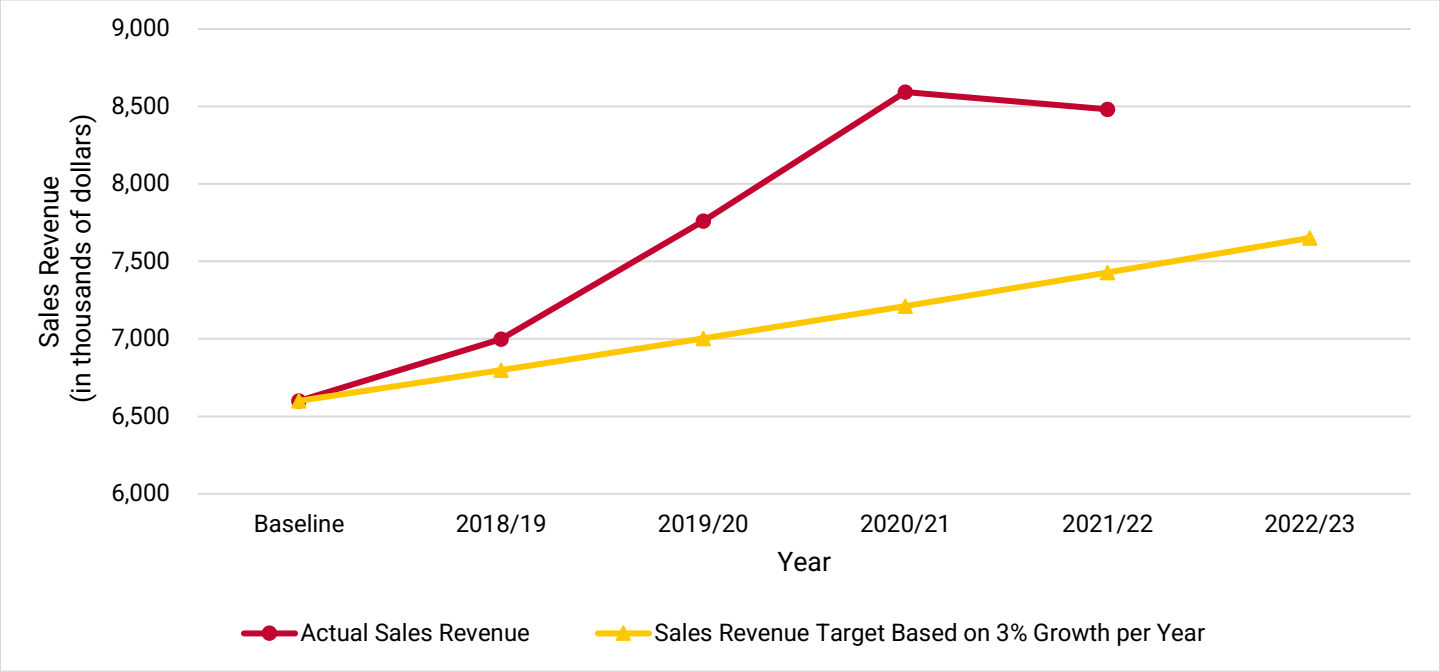
5.2.1 Increase in Revenues

In 2021/22, AHL failed to meet the mandatory compliance requirement for a 3% annual increase in revenues. The revenue of $8.482M was a 1.3% decrease from the 2020/21 revenue of $8.593M. Figure 5.1 shows the AHL revenue over the term of the Agreement compared with the 3% growth target.

The reasons for the decreased revenue are several, the most important of which is the inability of any organization to attain straight-line growth targets given the vagaries of fluctuating business cycles. In the preceding three years of the Agreement, AHL achieved 6.0%, 10.9%, and 10.7% growth in annual sales revenue, far surpassing the target of a 3% annual increase. Even with this year's slight decrease, the cumulative growth is still significantly above the expected target.

Revenue growth in 2019/20 and 2020/21 was strongly supported by a large number of high volume swine export cases which inflated Virology revenues significantly. These export cases were far fewer in number during 2021/22, possibly due to transportation challenges because of COVID-19, or resolution of the world-wide shortage of swine breeding stock, caused by the ASF epidemic that was the driver for increased Canadian swine exports. In 2022/23, it is expected that AHL will once again achieve the mandatory growth target, due to anticipated strong demand for testing in several laboratory sections, including Avian Influenza outbreak testing that the Virology laboratory conducts for CFIA.

Figure 5.1: Actual AHL Sales Revenue over the Term of the Agreement Compared with the 3% Growth Target



5.2.2 Emergency Response Plan and Surge Capacity Plan

AHL has a comprehensive Emergency Response Plan and Surge Capacity Plan in place to ensure that AHL can fulfill the objectives of the Program Schedule. The Plan outlines business continuity procedures in the event of critical infrastructure outages, staff unavailability, pandemic, facility inaccessibility/evacuation, or a surge in service requirement. It was heavily utilized in response to the COVID-19 pandemic.

The list of essential staff for LSD is updated every fall in order to define staff expected to report to work in the case of a weather event or labour disruption.

Surge capacity is maintained year-round and has benefited from the acquisition of high-volume, leading-edge equipment. AHL performed 372,398 ELISA tests and 112,256 PCR reactions in 2021/22, in addition to ongoing development of new and improved tests. Given the current level of automation, bolstered by the acquisition of four additional thermocyclers, AHL can easily accommodate additional testing in an emergency or surge capacity event.

5.2.3 Emergency Simulation Exercises

The University confirms that Emergency Simulation Exercises and Emergency Response Evaluations are typically performed annually in accordance with the Emergency Response Plan. The Guelph Emergency Exercise was held on April 7, 2022 and simulated a case of African Swine Fever. The Kemptville Emergency Exercise, scheduled for March 2022, was postponed due to the unavailability of CFIA staff who had been redeployed to manage the Ontario Avian Influenza outbreak. The postponed exercise will be conducted at the earliest convenience following the resolution of the staff shortages. More details are provided in Section 5.3.5.

5.2.4 Capacity Strategy Plan

Capacity planning is managed Division-wide in the LSD Essential Level Continuity Plan, v.3.0, 2020. Capacity for routine testing as well as for surge events is contingent on adequate staffing, which is an active process of needs assessment, recruitment, training, and retention. Human resource planning is supported by the various processes embedded in the Lab Services quality program.

5.2.5 Capital Strategy Plan

A capital expenditure program (CAPEX) is embedded in the operations of Laboratory Services Division. Equipment repair costs are closely monitored, and equipment is replaced prior to failure or when no longer supported by manufacturers. New OMAFRA program initiatives and client demands drive planning around the purchase of additional equipment to support new testing. Following several years of restricted equipment replacement due to the economic uncertainty posed by the COVID-19 pandemic, planned purchases were resumed and accelerated during 2021/22 to ensure the maintenance of AHL operations which are dependent upon reliable, high-performing equipment. Computer hardware and software are replaced on a planned basis to keep pace with management of increased volumes of data.

5.2.6 Fee Schedule

The up-to-date AHL Fee Schedule is provided to the Ministry annually and is also available on request.

5.2.7 Coordination of the Ontario Animal Health Network

AHL is responsible for coordinating the Ontario Animal Health Network, which was embedded in the renewed OMAFRA-UofG Agreement with funding for OAHN Operations, as well as for OAHN Projects. Nine OAHN expert networks were functional in 2021/22, including the work to add a new sub-network, namely the small flock poultry network. The networks have continued regularly scheduled communications and information-sharing with the objective of baseline health monitoring and flagging of changes in disease trends, to mitigate the risk of epidemics before they arise. Most networks also complete projects aimed at filling a gap in disease surveillance in their commodity. Section 5.4.5 provides more details about the projects awarded in 2021/22.

Work continued in 2021/22 on the integration of Ontario animal health surveillance data with national databases, such as the Canadian Animal Health Surveillance System (CAHSS). AHL is an active participant in CAHSS governance and in various CAHSS committees, including swine, poultry, equine, and bovine species. AHL continues to collaborate in building a 'network of networks' that will best serve provincial and national interests. Section 5.4.6 includes additional information on OAHN communications.

5.2.8 AHL Accreditation

The University maintains appropriate accreditations of the Animal Health Laboratory, including ISO/IEC 17025, and AAVLD.

American Association of Veterinary Laboratory Diagnosticians (AAVLD) Accreditation

AHL is audited every five years to maintain full AAVLD accreditation, all species. The last AAVLD audit was May 6 to 9, 2019 and the audit was successful with AHL retaining full accreditation, all species, for the five year maximum. Due to COVID-19, AAVLD delayed audits by one year and extended all labs' accreditation statuses for one additional year. AHL accreditation will now expire on December 31, 2025.

ISO/IEC 17025 Accreditation

Laboratory Services Division, including AHL, is accredited by the Standards Council of Canada (SCC) to the ISO/IEC 17025 standard, for the specific tests listed on the scope of accreditation. LSD is audited biennially by SCC to maintain accreditation and the current scope of accreditation is available on the SCC website. SCC will conduct their next biennial audit of LSD in Fall 2023.

LSD is accredited by SCC in the program specialty areas: Agriculture Inputs, Food, Animal Health and Plant Protection (AFAP) and Test Method Development and Evaluation and Non-routine Testing (TMDNRT). Based on the April 13, 2022 SCC scope, LSD has 106 SCC accredited tests and 21 accredited techniques - 88 AFL tests with 15 techniques and 18 AHL tests with 6 techniques. For a method to be accredited, competence must be demonstrated by submitting the method, forms, training records, validation/verification records, proficiency testing results and an internal audit report for the method to SCC for inspection.

In the past year, four AHL methods were added to the SCC scope:

- BAC-040 Culture detection of *Salmonella* Pullorum*, Salmonella* Gallinarum, and other *Salmonella* spp. from suspicious reactor birds;
- BAC-041 Whole genome sequencing (WGS) of bacterial isolates;
- V-002 ELISA for *Pasteurella multocida* toxin (PMT) antigen; and
- V-005 Polymerase Chain Reaction for PMT gene.

ISO/IEC 17025 Accredited Techniques (Flexible Scope)

AHL uses SCC's "flexible scope" option to accredit tests more rapidly by maintaining a list of methods covered under flexible scope.

AHL identifies unknown hazards in a range of matrices, for example, animal samples, feed, soil, and plants. Hazards include infectious agents (bacteria, mycoplasmas, yeasts, molds, viruses, and parasites), organic and inorganic elements, and compounds. Infectious agents are detected directly or indirectly through various technologies listed under LSD's SCC scope of accreditation.

Tables 5.4 to 5.9 below list AHL's SCC accredited techniques, as well as the list of test methods accredited under flexible scope for the agents specified (as of February 7, 2022).

Table 5.4: Culture Detection of Microorganisms

Method Code	Method Name	Agent
MYC-100	*Mycoplasma* and *Ureaplasma* isolation	• *Mycoplasma*, *Ureaplasma*, *Acholeplasma* spp.

Table 5.5: Inorganic Analysis by Inductively Coupled Plasma (ICP)

Method Code	Method Name	Elements
CHEM-162	Inductively Coupled Plasma - Mass Spectrometry (ICP-MS) analysis of trace metals in serum, plasma, and blood	• Manganese, iron, cobalt, copper, zinc, selenium, molybdenum, lead

Table 5.6: Enzyme Linked Immunosorbent Assay (ELISA)

Method Code	Method Name	Agent
V-002	ELISA	• *Coxiella burnetii* (Q fever) • Transmissible gastroenteritis virus (TGEV)

Table 5.7: Agglutination

Method Code	Method Name	Agent
V-008	*Leptospira* microscopic agglutination test (MAT)	• *Leptospira* spp.
V-007	Agglutination – *Brucella, Mycoplasma, Salmonella*	• *Salmonella Pullorum/Salmonella Gallinarum*

Table 5.8: Polymerase Chain Reaction (PCR)

Method Code	Method Name	Agent
MOL-181	*Mycoplasma bovis* real-time PCR	• *Mycoplasma bovis*
MOL-197	PCR detection of avian mycoplasmas	• *Mycoplasma gallisepticum* • *Mycoplasma iowae* • *Mycoplasma synoviae*
MOL-218	*Chlamydia* PCR	• *Chlamydia abortus* • *Chlamydia psittaci* • *Chlamydia suis*
MOL-235	Real-time PCR detection of *Pseudogymnoascus destructans*	• *Pseudogymnoascus destructans* (formerly *Geomyces destructans*)

Method Code	Method Name	Agent
	(formerly *Geomyces destructans*)	
MOL-251	Honey bee molecular testing	• Acute bee paralysis virus (ABPV) • Black queen cell virus (BQCV) • Chronic bee paralysis virus (CBPV) • Deformed wing virus (DWV) • Israeli acute paralysis virus (IAPV) • Kashmir bee virus (KBV) • Sacbrood virus (SBV)
MOL-257	Chytrid PCR (Batrachochytrium dendrobatidis & B. salamandrivorans)	• *Batrachochytrium dendrobatidis* • *B. salamandrivorans*
MOL-262	*Echinococcus* species PCR	• *Echinococcus multilocularis*
MOL-267	*Myxobolus cerebralis* (whirling disease pathogen) PCR	• *Myxobolus cerebralis*
V-005	PCR	• Bluetongue virus (BTV) / Epizootic hemorrhagic disease virus (EHDV) • Infectious bovine rhinotracheitis virus, bovine herpesvirus 1 (IBRV) • Infectious laryngotracheitis virus (ILTV gallid herpesvirus 1 [GaHV-1[) • Porcine circovirus 2 (PCV-2) • Porcine parvovirus (PPV) • Porcine respiratory coronavirus (PRCV) • Severe acute respiratory syndrome virus 2 (SARS-CoV-2) – E gene and (SARS-CoV-2) – RdRp gene

Table 5.9: Whole Genome Sequencing (WGS)

Method Code	Method Name	Agent
BAC-041	WGS of bacterial isolates	• Bacterial isolates

In the past year, the following changes were made to AHL's list of methods accredited under flexible scope. Five MOL-251 bee PCR methods were removed from the list: *Spiroplasma apis, Crithidia mellificae, Spiroplasma melliferum*, *Tropilaelaps* screening, and varroa haplotyping. Whole genome sequencing (WGS) was added to the SCC accredited techniques and method BAC-041, as shown above in Table 5.9, was added to the list of methods accredited under flexible scope.

2021/22 AHL Proficiency Testing Results Summary

Proficiency Testing (PT) Programs

AHL received reports for participation in 72 different proficiency test programs in 2021/22. PT programs are divided into two main categories:

- Chemical PT programs – produce numerical results and the results are usually categorized as satisfactory, questionable, and unsatisfactory; and

- Biological PT programs – a panel of samples are tested, or identification agrees with consensus ID and results are usually pass / fail, where pass includes satisfactory and questionable results.

When a PT result is identified as questionable or unsatisfactory, the problem is investigated, and for unsatisfactory results corrective action is applied and documented.

Chemical PT Programs

In 2021/22, the chemical sections of AHL, Clinical Pathology and Toxicology, participated in 20 different PT programs. Note that multiple sets of samples were tested within many of the PT programs. AHL reported over 1,500 chemical PT results. A summary of chemical PT results is available for onsite review.

Overall, the chemistry results are as follows:

- Satisfactory: 97.5% (95.4% satisfactory and 2.1% questionable); and
- Unsatisfactory: 2.5%.

Biological PT Programs

In 2021/22, AHL reported 522 biological results or panels in 52 programs. The programs are listed in Table 5.10 below. The number of proficiency samples was higher than last year, due in part to some programs resuming operation following a pause caused by the pandemic.

Overall, the biological results are as follows:

- Pass: 99.4%; and
- Fail: 0.6%.

Table 5.10: 2021/22 AHL Biological Proficiency Results

Lab Section	Proficiency Program	Parameter	Scoring Criteria	Results Reported	Pass
Bacteriology	NVSL – Johne's disease direct PCR and pooled direct PCR	*Mycobacterium avium paratuberculosis* (Johne's disease)	Agreed with expected results	25	25
Bacteriology	VETQAS PT0088	*Salmonella* in poultry	Agreed with expected results	40	40
Bacteriology	VETQAS PT0180	*S.* Pullorum, *S.* Gallinarum, *S.* Arizonae in poultry	Agreed with expected results	15	15
Bacteriology	FDA-CFSAN-WGS Program GT CDC, 2021GenomeTrakr PT exercise	Whole genome sequencing	Lab achieved passing status	4	4
Bacteriology	VETQAS PT0200	Whole genome sequencing	Agreed with expected result	10	10
Bacteriology	VETQAS PT0192	*Brachyspira* species	Agreed with expected results	8	8
Bacteriology	VLA-QAP BACT1	Culture isolation and bacterial identification	Agreed with benchmark	2	2
Bacteriology	VETQAS PT0060	Mastitis	Agreed with expected results	6	6

Lab Section	Proficiency Program	Parameter	Scoring Criteria	Results Reported	Pass
Bacteriology	AAVLD Internal Bacteriology Quality Assurance Survey (IBQAS)	Organism ID and susceptibility	Agreed with consensus	4	4
Histotechnology	VETQAS PT0167	Staining techniques	Good (3 or above) or poor (2 or lower) performance	20	20
Molecular Biology	CFIA–OLF CWD genotyping by PCR	Prion protein (PrP) genotype	Agreement between labs	19	19
Molecular Biology	VETQAS PT0136	Koi herpesvirus	Agreed with expected results	5	5
Molecular Biology	ILC with UoG Pathobiology lab	Viral hemorrhagic septicemia virus	Agreement between labs	5	5
Molecular Biology	VETQAS PT0126	*Mycoplasma hyopneumoniae*	Agreed with expected results	5	5
Molecular Biology	GD Animal Health VLDIA303	*M. gallisepticum, M. synoviae*	Agreed with expected results	8	8
Molecular Biology	ILC with Prairie Diagnostic Services	*Chlamydia abortus, C. psittaci*	Agreement between labs	10	10
Molecular Biology	VLA-QAP BACT2 (Aquatic Bacteriology)	Bacterial identification	Agreed with benchmark	2	2
Molecular Biology	VETQAS PT0150	*Mycoplasma hyopneumoniae*	Agreed with expected results	5	5
Parasitology	VLA-QAP Parasite Identification	Parasite ID	Agreed with benchmark	3	3
Pathology	VLA-QAP Mammalian Histopathology	Morphological diagnosis/ interpretation	Agreed with benchmark	4	4
Virology	USDA NVSL 2021 Anaplasmosis PT (ANP-CHK)	*Anaplasma marginale*	Passing score at 90% or above required for both quantitative and qualitative determination	1	1
Virology	CFIA CAHSN panel, BTV ELISA (IDEXX)	BTV	Analyst passed panel	3	3
Virology	CFIA EIA ELISA panel	EIA	Analyst passed panel	6	6
Virology	CFIA CAHSN FMD-3ABC cELISA	FMD	Analyst passed panel	3	3
Virology	CFIA CAHSN AIV ELISA	AIV	Analyst passed panel	6	6
Virology	GD Animal Health VLDIA333	IBR	Agreed with consensus	8	8

Lab Section	Proficiency Program	Parameter	Scoring Criteria	Results Reported	Pass
Virology	VETQAS PT0074	PMT toxin, toxA (gene encoding PMT)	Agreed with expected result	8	8
Virology	CFIA CAHSN Inf-A/APMV RRT-PCR	Inf-A	Analyst passed panel	16	16
Virology	CFIA CAHSN Inf-A/APMV RRT-PCR	APMV	Analyst passed panel	16	16
Virology	CFIA CAHSN ASFV PCR	ASFV	Analyst passed panel	12	12
Virology	CFIA CAHSN CSFV RRT-PCR	CSFV	Analyst passed panel	13	13
Virology	CFIA CAHSN FMDV PCR	FMDV	Analyst passed panel	7	7
Virology	ILC with Biovet	Porcine coronavirus (PEDV, PDCoV, TGEV)	Agreement between labs	18	18
Virology	GD Animal Health VLDIA290	PRRSV	Agreed with expected results	16	16
Virology	CFIA Rapid Test Proficiency Panel (BioRad TeSeB SAP ELISA)	BSE	Analyst passed certification	5	5
Virology	CFIA-OLF ELISA OIE and National Reference Laboratory for Scrapie and CWD	PrP Scrapie/CWD	Analyst passed certification	10	10
Virology	USDA NVSL PRRS IFA	PRRSV	Agreed with expected results	20	20
Virology	ILC with University of Montreal	*Coxiella burnetti* (Q fever)	Agreement between labs	8	8
Virology	ILC with Biovet	PRCV/TGEV	Agreement between labs	12	12
Virology	ILC with University of Montreal	IBR	Agreement between labs	6	6
Virology	ILC with University of Montreal	ILTV	Agreement between labs	6	6
Virology	ILC with University of Montreal and Iowa State University	PPV	Agreement between labs	6	6
Virology	ILC with University of Montreal	PRCV	Agreement between labs	6	6
Virology	GD Animal Health VLDIA233	Antibodies against Salmonella	Agreed with consensus	8	8
Virology	GD Animal Health VLDIA255	aMPV	Agreed with consensus	8	8

Lab Section	Proficiency Program	Parameter	Scoring Criteria	Results Reported	Pass
Virology	GD Animal Health VLDIA277	ARV (REO)	Agreed with consensus	8	5[24]
Virology	GD Animal Health VLDIA286	BVDV	Agreed with consensus	8	8
Virology	GD Animal Health VLDIA329	CAV	Agreed with consensus	8	8
Virology	GD Animal Health VLDIA172	IBDV	Agreed with consensus	8	8
Virology	GD Animal Health VLDIA235	SRLV (MVV/CAEV)	Agreed with consensus	12	12
Virology	VLA_QAP Serology/Immunology	Canine parvovirus, distemper and B. canis	Agreed with peer group consensus	12	12
Virology	GD Animal Health VLDIA314	IBDV	Agreed with consensus	8	8

5.2.9 AHL Testing Data

AHL Testing Data are held in compliance with Article 13.0 of the Agreement.

5.2.10 Resources to Administer AHL

The University confirms that it has the necessary resources, including technical and support staff, to administer AHL. Dr. Maria Spinato was appointed in Fall 2019 as the AHL Director and Co-Executive Director of Laboratory Services Division, as well as the AHL PMC Co-Chair. She is highly qualified to support the governance structure of the AHL PMC.

5.3 Key Performance Indicators

5.3.1 Biennial Client Satisfaction Survey

The Biennial Client Satisfaction Survey measures the level of satisfaction of AHL clients with the services provided and leads to actions needed to address areas for improvement. This performance measure includes assessment of the effective communication of test results to AHL clients. The target is 100% of action requests to be considered by the AHL PMC and, where appropriate, implemented by the UofG within a year. The Biennial Client Satisfaction Survey was last completed in Fall 2021 and is due again in Fall 2023.

[24] The unsatisfactory PT result was for V-002 (CAPA D220512-90).

Dr. Jim Fairles (AHL Client Services Veterinarian) presented an update at the Feedback Group meeting (November 26, 2021) on the 2021 survey that was sent to 952 major clients with 74 responses for an 8% response rate (considered a good response rate for an email survey).

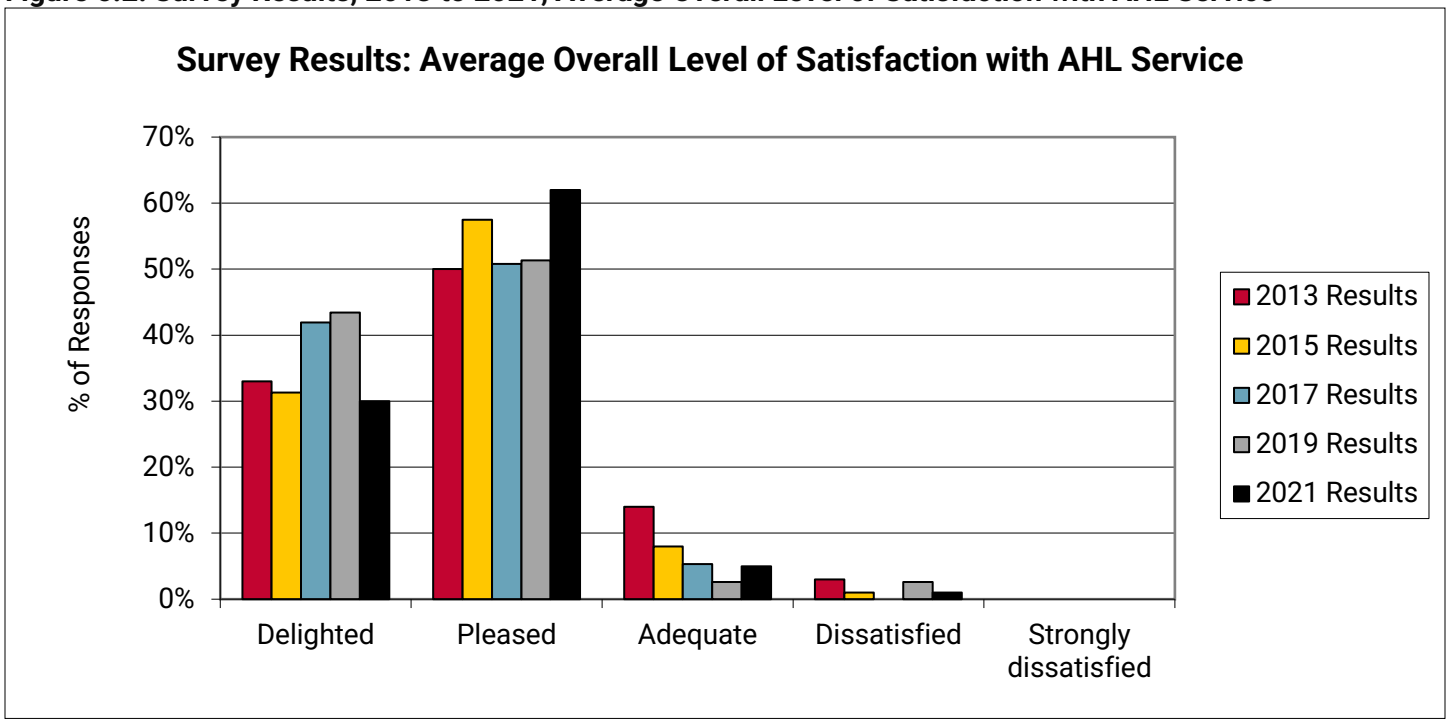
Overall level of satisfaction with AHL service was 93.2%.

Items suggested for client satisfaction improvement were in the areas of:

- Specific test turnaround times;
- Extended courier services;
- Use of diagnostic plans;
- Continuing to streamline reports;
- Communication of new tests, test use, and trends;
- Enhanced bacteriology susceptibility testing; and
- Continued enhancement of online submissions.

Overall, client feedback was that AHL provided excellent service. Figures 5.2 and 5.3 provide examples illustrating the results from the 2021 Biennial Client Satisfaction survey.

Figure 5.2: Survey Results, 2013 to 2021, Average Overall Level of Satisfaction with AHL Service



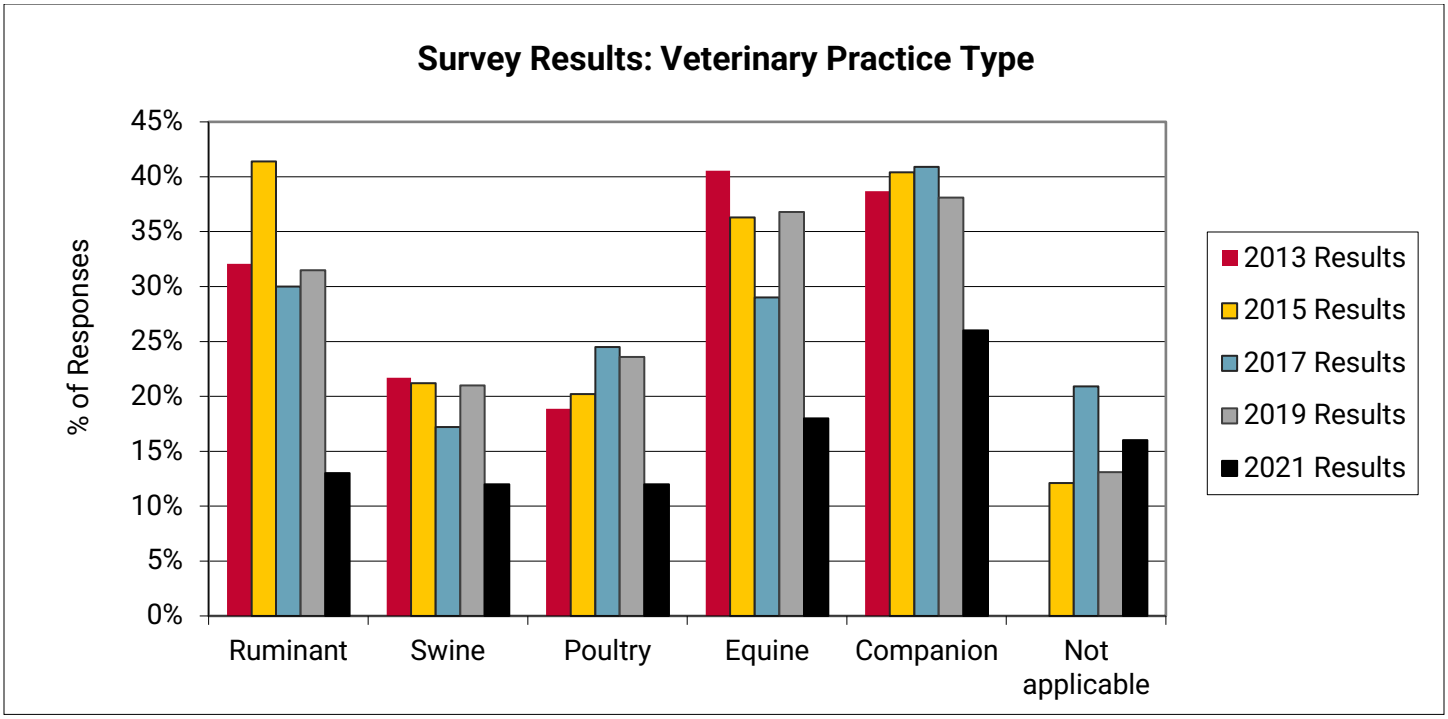


Figure 5.3: Survey Results, 2013 to 2021, by Veterinary Practice Type

The 2021 Biennial Client Satisfaction Survey Assessment and the 2020/21 and 2021/22 Feedback Group meetings identified the following action items and the continuous improvement outcomes, as outlined in Tables 5.11 and 5.12.

Table 5.11: 2020/21 Feedback Group Meeting Action Items and Outcomes

2020/21 Action Items	AHL Improvement Outcome Response
1. Look into broadening Turkey reovirus testing options	Ongoing – Added to "AHL new testing priority list" database – ongoing discussion with poultry vets.
2. Co-ordinate CWD testing, attempt to batch sample for efficiency	Completed – Coordination discussion with OMAFRA.
3. Look into expanding the susceptibility panels	Ongoing – Draft Antimicrobial Susceptibility testing document completed, including MIC.
4. Results throughout the day, rather than at end of day	Unable to comply – Results are approved and released when completed, which is usually the end of day.
5. Develop Equine panels – diarrhea and respiratory	Ongoing – Equine foal and adult diarrhea panels completed in May 2021. Equine respiratory panel under development.
6. Look into reporting options for patient bloodwork comparison	Completed – This is available in LIMS online by using multiple cases and combining in excel.
7. Explore Cadet_BRAF TAT	Completed – This is a send out. The test is sent and then data is entered as soon as possible by AHL.
8. Bovine Respiratory PCR panels	Completed - Bovine Comprehensive Respiratory Panel developed and released.

2020/21 Action Items	AHL Improvement Outcome Response
9. PCR Mastitis panels	Ongoing - Added to "AHL new testing priority list" database.
10. PID promotion	Ongoing - AHL is updating the client portal. Once completed, clinic client database options will be offered which will have the option to include PID and automatically add it to AHL online submissions.
11. Botulism inoculation test TAT	Completed - This is currently a send out. The test has a long TAT. AHL is unable to improve the TAT.
12. IDvet ID SCREEN® ILT gI Elisa 13. Biochek ND F-Elisa or IDvet ID Screen ND indirect 14. IDvet ID SCREEN® IBD VP2 Elisa 15. Synbiotic's PROFLOK Plus IBD	Ongoing - These are Poultry industry tests currently available as send outs. They have been added to "AHL new testing priority list" database and ongoing discussion with poultry veterinarians are occurring regarding the business case.

Table 5.12: 2021/22 Feedback Group Meeting Action Items and Outcomes

2021/22 Action Items	AHL Improvement Outcome Response
1. Highlight non-negative results	Unable to comply - In discussion with IT. It would require a full system change to implement.
2. Bulk tank *Salmonella* Dublin in-house at AHL (courier fee more than test)	Ongoing
3. Investigate late week bacteriology submissions and reduced TAT. Multiple comments: Thursday to Monday slowdown, TAT slow	Ongoing
4. More frequent whole genome sequencing?	Ongoing – Under development.
5. Fish submission process, investigating the workflow-survey feedback as well	Completed - Discussed with Molecular Biology regarding flow, client emails now forwarded to Molecular Biology to manage receipt and return of coolers.
6. Webi slow	Completed - IT assessed Webi and performed a system reboot which increased system speed and stability.
7. Report format	Unable to comply
8. Email species specific information on new tests in a more targeted way	Ongoing
9. AHL reports-check with IT if way to suppress last page if no data included	Ongoing
10. Virus isolation options	Completed - Virology has some limited options for virus isolation available upon request.
11. Investigate slow TAT Bacteriology	Ongoing
12. Investigate bottle necks in laboratory flow	Ongoing

5.3.1.1 AHL Feedback Meeting, November 26, 2021

List of Participants

OMAFRA

- Dr. Cathy Furness
- Dr. Tim Pasma

Species Group Presidents

- Dr. Ben Schlegel – Ontario Association of Poultry Veterinarians
- Dr. Clint Lichty - Ontario Association of Swine Veterinarians/South West Ontario Veterinary Services
- Dr. Rex Crawford – Small Ruminants Veterinarians of Ontario/Dufferin Veterinary Services

Large Volume Clients

- Mr. Andrew Sweet – Hendrix
- Dr. Chanelle Taylor – Cargill Poultry
- Dr. Kevin Vilaca – South West Ontario Veterinary Services

Private Practice

- Dr. Rob Swackhammer – Upper Grand Veterinary Services
- Dr. Stacey Novy – Guelph Poultry

Ontario Veterinary College

- Dr. Brandon Lillie – Pathobiology Chair
- Dr. Janet Beeler-Marfisi – Ontario Veterinary College-Health Science Centre (OVC-HSC) Pathobiology
- Dr. Daniel Kenny – OVC-HSC Large Animal Internal Medicine

AHL

- Dr. Tanya Rossi - OAHN Coordinator
- Ms. Josie Given - Client Outreach Technician
- Ms. Rina Pigozzo - Client Services Technician
- Dr. Jim Fairles - Client Services Veterinarian
- Dr. Maria Spinato - Director

As a documented form of feedback on client service, minutes of the bi-monthly AHL/OVC-HSC/Pathobiology Liaison meetings and the annual AHL Feedback Group meeting (of which a range of AHL clients attend) were reviewed. Meeting minutes are available upon request. Satisfaction is high with the timeliness of communications.

5.3.2 Relevant Test Results and Reporting Times

In 2021/22, AHL continued to provide excellence in meeting Service Level Standards and quality for routine tests, assessed through multiple measures: the number of tests, case and test load distribution by species, and compliance with Service Level Standards, specifically turnaround time (TAT).

Turnaround time is one of the most critical measures of a laboratory's effectiveness and efficiency. Client loyalty is often based on this one aspect of service. Given the large number of tests and services provided, it is

often a challenge to maintain turnaround time and manage clients' expectations. AHL proactively measures and analyzes TAT performance to identify areas needing improvement. A component of the AHL's AAVLD accreditation is an analysis of adherence to quoted TAT expectations as published in the AHL User's Guide and Fee Schedule. A detailed explanation of the 2021/22 TAT statistics report is available upon request.

The target of 95% of routine AHL tests meeting the published Service Level Standards was set in 2018/19. The AHL Service Level Standards reporting includes service levels from external testing facilities in the target reporting, which are not controllable. In 2021/22, AHL met the target, showing that 96.55% of tests met the expected Service Level Standards, based on the calculation from LIMS. This achievement is notable given the challenges posed by the Omicron wave of the COVID-19 pandemic. Between January and April 2022, staffing levels were significantly reduced at times due to family and medical leaves related to COVID-19. The dedication of AHL staff ensured that target TATs and clients' testing needs were met throughout this period.

Table 5.13 shows the percentage of AHL tests achieving the published service level standards over the term of the Agreement. AHL has exceeded the standard in three of the last four years. 2019/20 was heavily impacted by the COVID-19 pandemic.

Table 5.13: AHL Tests Achieving the Published Service Level Standards, over the Term of the Agreement

Percentage of AHL Tests Achieving the Published Service Level Standards	97.6%	93.48%	98.48%		95.00%

Table 5.14 and Figures 5.4 to 5.5 below provide additional information on the number of tests, the caseload and procedure distribution by laboratory section, and the caseload and procedure distribution by species. Table 5.15 shows the AHL caseload over the term of the Agreement.

Table 5.14: AHL Caseload and Procedures Distribution, by Laboratory Section, 2021/22

AHL Function	Number of Cases	Number of Procedures[25]
Anatomic Pathology	2,465	2,496
Bacteriology	13,739	65,860
Clinical Pathology	22,404	52,631
External	2,378	5,682
Histotechnology	5,892	7,643
Mycoplasmology	2,690	10,178
Parasitology	3,326	6,054
Toxicology	3,398	10,594
Virology	21,148	587,212
Total	**77,440**	**748,350**

Table 5.15: AHL Caseload and Procedures over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23
Number of Cases	75,788	72,111	77,584	**77,440**	
Number of Procedures	846,972	798,358	770,377	**748,350**	

[25] Procedures such as biochemical profiles include multiple tests.

Figure 5.4: AHL Caseload Distribution, by Cases and Species, 2021/22[26]

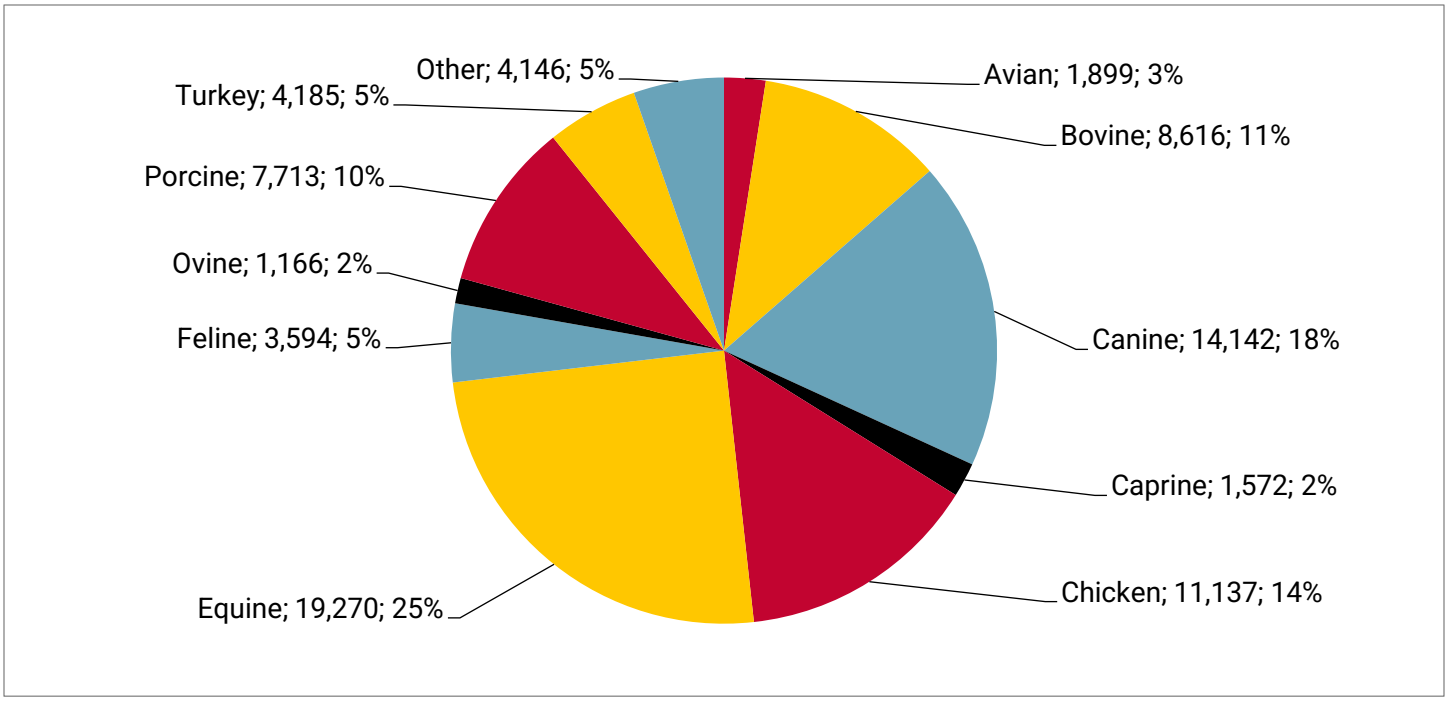
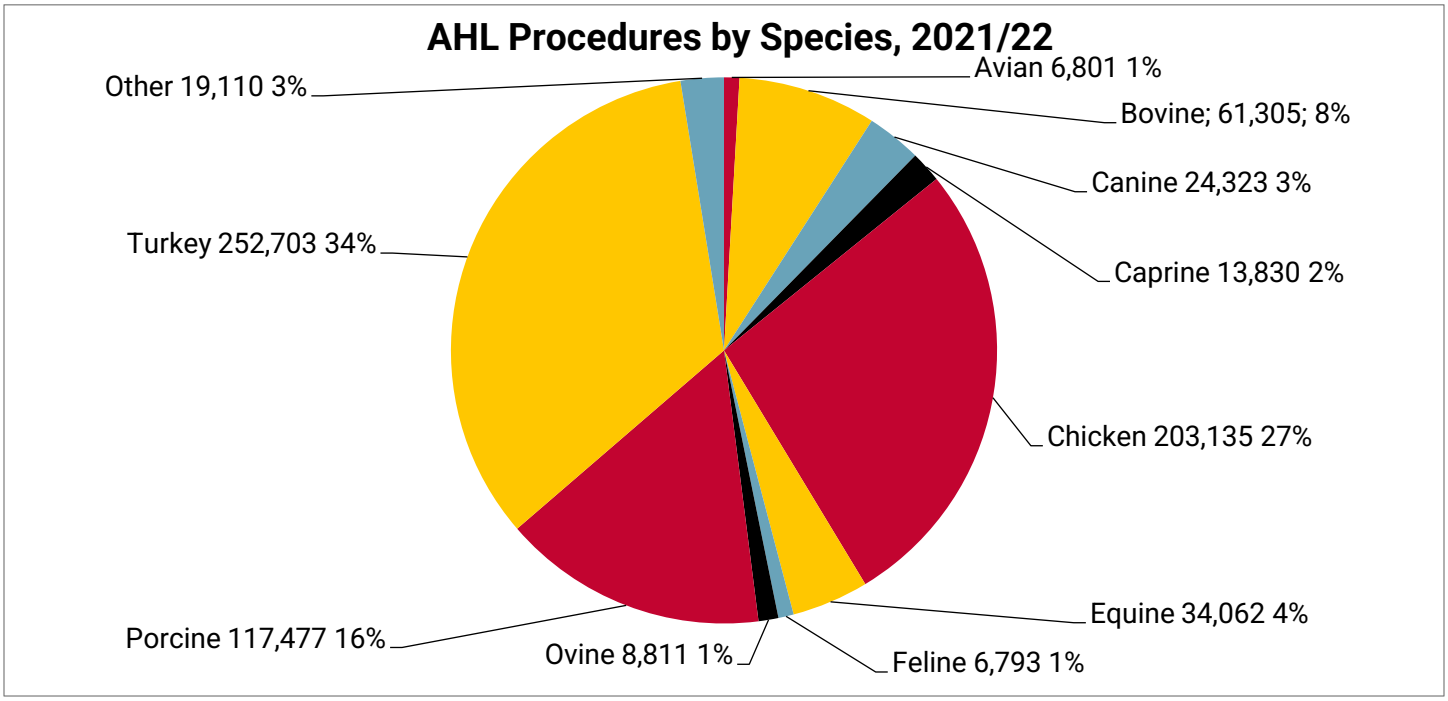


Figure 5.5: AHL Caseload Distribution, by Procedures and Species, 2021/22[27]



[26] Other includes bees, fish, mink, rabbit, other animals, and non-animal.

[27] Other includes bees, fish, mink, rabbit, other animals, and non-animal.

5.3.3 Comprehensive Database

AHL is responsible for uploading accurate and accessible data. Results of testing of Ontario food animal submissions are housed in a data warehouse accessible to OMAFRA. AHL designs Web Intelligence (WebI) searches for OMAFRA to access disease events and disease trends within data stored in the warehouse. Dr. Tim Pasma, OMAFRA Epidemiologist, is an active member of the WebI Users Group.

There was one occurrence when data was inaccessible over the past year. This took place on Thursday, August 26, 2021 when the WebI server hardware failed. An email was sent to inform Dr. Pasma and advise that data related to his queries could still be extracted if needed. Dr. Pasma replied that he would not require any data runs until Monday, August 30, 2021. IT staff worked over the weekend to remap the database, which was back online on Sunday, August 29, 2021. The root cause of this incident was the failure of an older server that had been scheduled for replacement. The solution was to replace the server.

The target for this metric is 100% of issues resolved. AHL met this target in 2021/22.

The IT process improvements that occurred over 2021/22 are listed below:

- 2021-05 – Create new Sequencing module and reporting format to facilitate easier data reporting and mining of sequencing results. A new Tramstop was developed and an automated process for adding sequencing results using a database of results. Completed.
- 2021-06 – Automate the process of requesting clinician information from VTH based on error messages obtained when a VET ID is missing. Completed.
- 2021-07 – Increase the level of security on client reports so that they can only be printed. All other permissions will be locked. This applies to reports which are viewed, sent manually and automatically from LIMS. Exceptions to this policy will be approved by the Co-Directors. Completed.
- 2021-09 – Have a call-in number for Teams meetings for external users or staff that are unable to use a computer or smart phone. The phone numbers have been assigned to the AFL information account and the AHL administration account. Completed.
- 2021-09 – Encrypt workstations for added data security at the workstation level. This is a campus-wide initiative and requirement. Completed.
- 2021-10 – Enact CAPA improvement project for invoice corrections - noting if a new invoice is required. Proposed CAPA field addition. Completed.
- 2021-10 – Increase the client/sample ID column from 30 characters to 80 characters so that it can accommodate the login of client samples when the client sample ID is greater than 30 characters. This will allow the Sample/Specimen Reception areas to log the sample in with the correct ID initially as opposed to having to correct the IDs on the sample pages. This will also reduce the likely hood of forgetting and having to revise a report with the correct IDs. Completed.
- 2021-11 – Purchase and implement Dropbox as an online storage solution for the long term retention of large amounts of data generated by the labs. Also works as an FTP solution for sending large files out to external clients securely. Completed.

5.3.4 Premises Identification

Premises Identification was removed as a key performance indicator as part of the Animal Health Laboratory's program outcomes and objectives and will be captured as a reporting requirement instead. This was approved by the Executive Committee on June 2, 2021. For more details on Premises Identification for 2021/22, please see Section 5.4.9.

5.3.5 Emergency Simulation, Exercise and Response

This performance indicator addresses AHL's ability to effectively carry out its responsibilities for emergency simulation, exercise, and response to effectively support the Ministry. It also looks at AHL's ability to develop continuous improvement action requests through the simulation/exercise evaluation report. Areas of improvement are identified by the Ministry and the University in response to AHL's participation in Incident Management System (IMS) simulation exercises.

The target is that 100% of action requests are implemented by the University within one year. Actions were developed, as agreed with the AHL PMC, to address recommendations in 2020/21, with an outcome of 100% of the action requests implemented by the University within the year. Due to the postponement of 2019/20 Foreign Animal Disease (FAD) exercises because of COVID-19 restrictions, there were four exercises conducted in 2020/21; associated action items are reported below. AHL-Guelph was able to hold its scheduled 2021/22 FAD exercise in April 2022 and this report, including evaluators' comments and action items, is also detailed below. The 2022 emergency exercise at AHL-Kemptville, initially scheduled for March 2022 (handling of a Highly Pathogenic Avian Influenza (HPAI) suspect through swabbing and containment within the truck bay), was postponed due to unplanned staff shortages for available external auditors, as a result of both field deployment of regional CFIA veterinary officials in the current national HPAI outbreak and the ongoing COVID-19 pandemic. The postponed exercise will be conducted at the earliest convenience following resolution of staff shortages.

5.3.5.1 Completed Action Items for 2020/21 FAD Emergency Exercises

AHL-Guelph - Foreign Animal Disease Exercise, held November 4, 2020

Exercise coordinator: Andrew Brooks, AHL.

Background: A foreign animal disease emergency exercise was held at AHL-Guelph, November 4, 2020, simulating a suspected case of African Swine Fever.

External evaluators: Dr. Christa Arsenault (OMAFRA), and Dr. David Orr (CFIA).

Overall assessment: The exercise was successful, and all objectives were completed.

Action items arising from the exercise:

Action 1: Make a record of approved disinfectants and concentrations that match with CFIA recommendations, for different foreign animal diseases in the Postmortem (PM) room.

Response 1: **Action Closed** (Brooks, December 18, 2020). As per email discussions with Dr. Orr, the CFIA does not maintain lists of all products marketed in Canada effective against various regulated pathogens as it is constantly changing. Prevail has been recognized by Health Canada and CFIA as being effective against the ASF. AHL has access to various disinfectants (Prevail, Virkon, bleach etc.) and would consult with CFIA about which disinfectant was preferred for a particular agent.

Action 2: Find a better way to affix disease alert signs to the outside of the building to prevent them from blowing off in the wind.

Response 2: **Action Closed** (Brooks, March 11, 2021). Velcro adhesive is being used to adhere the alert signs to doors, instead of tape. The Velcro worked well in the subsequent exercise on March 11, 2021.

Action 3: Expand the list under exercise objective 3 to include all tasks performed by the AHL Director in the notification process. Include notification of the CVO.

Response 3: **Action Closed** (Brooks, March 11, 2021). The exercise guide has been updated under objective 3 to list the notifications performed by the AHL Director: Specimen Room Supervisor, Postmortem Supervisor, Pathobiology Chair, Chief Veterinary Officer for Ontario.

Action 4: Ensure that barrels marked with "FAD and HOLD" do not have any risk of being picked up by the contracted company until negative testing results are known and communicated by CFIA to prevent them from crossing the Canada - USA border.

Response 4: **Action Closed** (Brooks/MacAlpine, December 18, 2020). As per Section 9.3.17 of AHL-002 *Postmortem procedures manual*, the suspect carcass remains are held until the AHL Director determines the timing and disposal with CFIA.

Action 5: Work with CFIA on a possible local location that may be able to help with incineration if a suspicious or a positive test result is received from the National Centre for Foreign Animal Disease (NCFAD) in advance of need.

Response 5: **Action Closed** (Brooks, April 11, 2022). The AHL Thermal Tissue Digester (TTD) would be an effective alternative to incineration performed by Daniels Health. If the TTD was not operational, AHL will consult with CFIA on alternative service providers to destroy the contaminated carcass.

Action 6: Make note in the SOP that in freezing temperatures cleaning and disinfection of the truck bay should be completed with the door closed to prevent water and disinfectant from freezing.

Response 6: **Action Closed** (Brooks, December 18, 2020). Cleaning and disinfection of the truck bay in the winter is already performed with the overhead door closed as a routine practice. There is also an air curtain which helps to keep cold air out of the truck bay while the door is temporarily open.

Action 7: Purchase timers for the PM room that can be set to monitor when recommended contact times with disinfection are met.

Response 7: **Action Closed** (MacAlpine, April 7, 2022). New timers have been purchased. Clocks are also present in the postmortem rooms to time disinfection.

Action 8: Consider rotating disinfectants routinely used in the PM room to prevent any resistance from developing over time.

Response 8: **Action Closed** (Brooks, December 18, 2020). The AHL postmortem room has several disinfectants available for cleaning and disinfection including Prevail, bleach, Virkon, Dynakil, etc. In the event of a FAD suspect, AHL will confirm with CFIA the disinfectant of choice.

Action 9: Redo the tape line in the shower room indicating dirty and clean areas for visual aid with biosecurity.

Response 9: **Action Closed** (Brooks April 7, 2022). Having reviewed and practiced the protocol several times, the most effective demarcation line between "clean" and "dirty" is the physical doorway between the room where coveralls are removed (PAPR storage room) and the shower room. The shower room also contains disinfectant for additional disinfection of that area if needed.

Action 10: Review email listserv requirements so all pathologists can send FAD simulation notifications out through the email listserv.

Response 10: **Action Closed** (Brooks, February 3, 2021). Confirmed all AHL pathologists have access to the listserv.

Action 11: Clarify plans for handling a FAD suspect that is detected in the regular PM room (while busy and with other occupants) or detected after the postmortem is over (e.g., detected at histopathology or culture).

Response 11: **Action Closed** (Brooks April 7, 2022). The procedure for handling an FAD suspect in the regular PM room was practiced at the most recent exercise on April 7, 2022. Detection of an FAD suspect after the postmortem has been completed would be reported to CFIA according to reporting protocols and AHL would follow CFIA guidance.

Action 12: Invite a biosecurity expert from Ottawa (CFIA) to attend the next FAD exercise at AHL.

Response 12: **Action Closed** (Brooks, April 7, 2022). Dr. Creighton of CFIA was invited to the original exercise in 2020 that was postponed due to the pandemic. Since then, AHL has conducted exercises with fewer numbers of local CFIA and OMAFRA personnel to limit the number of people in the PM room. As per Dr. Orr's suggestion, AHL will invite Dr. Snow of CFIA (or someone with comparable expertise) to the next exercise in Fall 2022.

Action 13: Inquire about AHL pathologists participating in future FAD training courses at NCFAD in Winnipeg.

Response 13: **Action Closed** (Brooks, March 3, 2021). Dr. Leah Seabrook of CFIA will contact AHL if a training opportunity arises.

Action 14: Inquire about a position or role for AHL at the FAD discussion table on the Ontario FAD team during a real FAD.

Response 14: **Action Closed** (Spinato, August 2021). Informal discussion with OMAFRA Animal Health leadership confirmed the critical laboratory testing conducted by AHL as its principal role during FAD outbreaks. Laboratory staff remain available to support the Ontario FAD team upon request.

Action 15: Provide to AHL pathologists at Guelph a review of the FAD procedure during the interval between annual exercises.

Response 15: **Action Closed** (Brooks, August 26, and September 23, 2021). FAD refresher sessions were held with AHL pathologists who had not recently participated in an exercise or an actual event (DeLay, Mansz, O' Sullivan, Brouwer).

AHL-Kemptville - Foreign Animal Disease Exercise, held November 18, 2020

Exercise coordinator: Heindrich Snyman, AHL.

Background: On November 18, 2020, the ninth annual foreign animal disease exercise was held at AHL-Kemptville. The simulated disease was African Swine Fever.

External evaluators: Dr. Ines Walther (National and OIE Reference Laboratory for Scrapie and CWD, Ottawa Laboratory Fallowfield, CFIA) and Dr. Nicole Schaefer (Veterinary Program Specialist and Supervisory Veterinarian, Ottawa District Office, CFIA).

Objective: To evaluate the ability of AHL-Kemptville personnel to conduct the appropriate sampling, decontamination, and reporting following SOP AHL-002 Postmortem procedures manual and AHL-002WI-5 Work Instruction for handling a foreign animal disease suspect at AHL-Kemptville – Action Summary, and to identify areas for improvement of the SOP or WI.

Overall assessment: The exercise was successful, and the objectives were completed. The exercise was a valuable training experience for AHL-Kemptville staff as well as evaluators. The evaluators provided useful and constructive feedback.

Action items arising from the exercise:

Action 1: Add additional laminated disease alert sign to be located in the loading bay for posting on loading bay entrances.

Response 1: **Action Closed.** Two additional laminated signs with Velcro attachments are now available for use on the overhead and side doors of the loading bay.

Action 2: Review AHL-002-WI-5 and AHL-OMAFRA-CFIA-OMH Animal Health Incident Reporting Protocol with updated contact numbers.

Response 2: **Action Closed.** AHL-002-WI-5 and AHL-OMAFRA-CFIA-OMH Animal Health Incident Reporting Protocol have been updated and republished.

Action 3: Consider running a notification-only exercise in addition to the annual FAD exercise.

Response 3: **Action Closed.** Requirement for a notification only exercise will be re-evaluated after the completion of the next scheduled full FAD simulation.

Action 4: Review procedures for disinfection and transferring sample containers out of the PM room and evaluate whether additional practice or revised instructions are required.

Response 4: **Action Closed.** Required end time of disinfection period will be labelled on the sample plate with a sharpie. Procedures for transferring sample containers out of the postmortem room are adequately described in the *AHL-002 Postmortem procedures manual*.

Action 5: Investigate the use of pre-packaged FAD prep-kits for PM room supplies as well as enclosure of minimal daily PM room supplies in clear snap lid Tupperware containers to better facilitate decontamination of the PM room and limiting the possible discard of supplies.

Response 5: **Action Closed.** Two sealable Tupperware containers are in use: one contains the daily postmortem room consumable supplies and the other contains the required consumable materials for use during enactment of the FAD procedure. A third sealable Tupperware container with the required consumable materials for enacting the swabbing of high suspect cases in the truck bay is also in use. Storage of other equipment that can readily be disinfected (e.g., knives, forceps, rib cutters etc.) will remain available on the designated racks and trays.

AHL-Guelph - Foreign Animal Disease Exercise, held March 11, 2021

Exercise coordinator: Emily Martin, AHL.

Background: A foreign animal disease emergency exercise was held at AHL-Guelph, March 11, 2021, simulating a suspected case of Highly Pathogenic Avian Influenza.

External evaluators: Dr. Tim Pasma (OMAFRA) and Dr. David Orr (CFIA).

Overall assessment: The exercise was successful, and all objectives were completed. The exercise was a valuable training experience for AHL - Guelph staff. The evaluators provided useful feedback.

Action items arising from the exercise:

Action 1: Conduct a simulation of clearing personnel from the postmortem room when a high-risk FAD suspect is identified in postmortem.

Response 1: **Action Closed** (Brooks, April 2, 2022). This action was simulated in the 2022 FAD exercise.

Action 2: Check with Dr. Davor Ojkic if the VTM swabs used at AHL would have concerns re: preservatives if the swabs were left in the container for long periods of time.

Response 2: **Action Closed** (Martin, April 2021). Plastic swabs are not a concern, they can be left in the media. If additional swabs need to be used and placed in the media, they cannot be wood handled swabs. These swabs have a virucidal preservative in the wood that could affect results. Always recommend plastic handled swabs for VTM media.

Action 3: Investigate how the doffing room and shower should be disinfected after shower-out procedures. Put a protocol in place for how to disinfect this area.

Response 3: **Action Closed** (Martin, April 2021). After the last person has showered out and exited the shower room, a clean postmortem technician disinfects the shower room and doffing room (PAPR storage room). This process has been incorporated into the FAD SOP and work instructions.

AHL-Kemptville - Foreign Animal Disease Exercise, held April 6, 2021

Exercise coordinator: Heindrich Snyman, AHL.

Background: On April 6, 2021, the tenth annual foreign animal disease exercise was held at AHL-Kemptville. The simulated disease was Highly Pathogenic Avian Influenza.

External evaluators: Dr. Benjamin Henderson (CFIA - Supervisory Veterinarian, Brockville and Belleville Animal Health Office, Ontario Operations, North East Region) and Mrs. Sheila Smiley (CFIA - Health and Safety Coordinator, Ottawa Laboratory Fallowfield).

Overall assessment: The exercise was successful, and the objectives were completed. The exercise was a valuable training experience for AHL-Kemptville staff, as well as evaluators. The evaluators provided useful and constructive feedback.

Action items arising from the exercise:

Action 1: Ensure disinfectant wipes (e.g., Prevail wipes) or paper towel that can be soaked in appropriate disinfectant is available for use for cleaning soiled surfaces and wiping high contact points in both the PM room and specimen reception area prior to spraying down with disinfectant.

Response 1: **Action Closed.** Paper towel is always available in the PM room and both paper towel and disinfectant wipes (Prevail) are available in the trimming room.

Action 2: Review AHL-002-WI-5 to include a step to ensure discussion of approved disinfection protocol with non-contaminated lab personnel prior to commencing postmortem evaluation/sampling. General review of all steps for this work instruction to be included at the same time.

Response 2: **Action Closed.** AHL-002-WI-6 *w*ork instruction was reviewed and updated with new version published in OMNI and posted in postmortem room.

Action 3: Review specimen reception and trim area disinfection plan and create a tabulated disinfection plan of surfaces to be included in the disinfection process.

Response 3: **Action Closed.** Point form list created through review and input from all AHL-Kemptville personnel to reflect conceivable surfaces, equipment, and items requiring disinfection during an FAD event.

Action 4: Review equipment used for application of disinfectant in the specimen reception, trim areas, and acquire necessary additions.

Response 4: **Action Closed.** Dedicated handheld pump action disinfectant sprayer is now available for use in the specimen reception and trim area.

Action 5: Notify by email all AHL-Kemptville and AHL-Guelph avian pathologists of swab handling and inclusion of cloacal swabs in the sampling protocol as per feedback from the NCFAD lab.

Response 5: **Action Closed.** Email was sent to all AHL avian pathologists notifying of this requirement.

Action 6: Review procedures for disinfection of sample containers in the PM room and evaluate whether additional practice or revised instructions are required.

Response 6: **Action Closed.** Various plastic/Tupperware containers are available for use for disinfection of sample bags instead of paper plates.

Action 7: Review options for improving privacy when transitioning from the postmortem room to the change room and shower.

Response 7: **Action Closed.** Given the small number of staff at AHL-Kemptville, timing for privacy when transitioning from the postmortem room to the shower is easy to manage through communication between staff members.

Action 8: Review options for including disinfectable outer footwear and an additional layer of clothing for transitioning from the postmortem room to the change room and shower.

Response 8: **Action Closed.** Tyvek suits are always available for use overtop of coveralls as a second external layer. A pair of disinfectable plastic crocs is available for each AHL-Kemptville staff member for use in transitioning from the PM room to the change room.

Action 9: Review AHL-OMAFRA-CFIA-OMH Animal Health Incident Reporting Protocol and AHL-002-WI-5 with updated contact details.

Response 9: **Action Closed.** Contact details updated and new WI published in OMNI (June 25, 2021). This is a living document that is updated whenever changes to notification contact details are identified or directly reported to AHL through federal and provincial partners.

5.3.5.2 Summary Reports for the 2021/22 FAD Emergency Exercises

AHL-Guelph - Foreign Animal Disease Exercise, held April 7, 2022

Participants: Dr. Andrew Brooks (AHL), Dr. Josepha DeLay (AHL), Megan MacAlpine (AHL), Courtney Bell (AHL), Abiran Sritharan (AHL), Dr. Jim Fairles (AHL), Jen Zoethout (AHL), and Dr. Courtney Schott (Pathobiology).

Summary: The foreign animal disease emergency exercise took place at AHL-Guelph, April 7, 2022, simulating a suspected case of African Swine Fever in the main PM room. The exercise was successful, and the objectives were completed.

External evaluators: Dr. Christa Arsenault (OMAFRA) and Dr. David Orr (CFIA).

Overall assessment: The exercise was successful, and all objectives were completed. The exercise was a valuable training experience for AHL - Guelph staff. The evaluators provided useful feedback.

Comments from the evaluators:

Dr. Arsenault had no further comments beyond the list of action items.

Dr. Orr's comments are below with AHL's responses.

- Many of the people leaving the PM room after a suspect FAD was identified will likely not be familiar with the exit procedures. If they are willing to listen and cooperate, the two bucket disinfection procedure will not be a problem. But he might guess that if three or four people are lined up, people will not intuitively use the buckets in sequence. There will be people at each bucket brushing their boots. To work as planned, the exit procedure will need monitoring by PM staff.
    - *AHL Response:* Agreed. The PM technical staff will supervise and monitor the exit of other personnel.
- Is the activation of the AHL-002 Postmortem Procedures Manual Section 9 dependant upon contacting the CFIA and/or the Director? If either cannot not be reached during a situation, would there be any difference? i.e., Is there any reason for not going forward with Section 9 of the manual, without having contacted CFIA and the Director?
    - *AHL Response*: CFIA and the acting director were successfully contacted. Activation of the FAD procedure is not dependent on having immediate contact with the CFIA or the AHL Director – if the case pathologist suspected a FAD, they would still follow the procedure. However, the likelihood of not being able to contact the CFIA or the AHL Director is low. Aside from the district office, the pathologist can contact the CFIA FAD hotline. When the AHL Director is away, there is always an acting director appointed.
- The instructions indicate that a decision was made during the exercise on whether or not to cancel pending and in-progress postmortems. Was the decision discussed during the exercise? Is there a situation when either would go forward?
    - *AHL Response:* AHL did not simulate other postmortems happening during the exercise, but in a real situation that may be the case and the decision to halt or cancel them would be made by the AHL Director, in collaboration with the PM supervisor and the Chair of Pathobiology. AHL anticipates that all postmortem activity would be stopped until the suspect case was dealt with, and the PM room was decontaminated. AHL will add this scenario of handling in-progress and pending postmortems to the next exercise (see Action 10).
- The primary and secondary containers are plastic bags, and they are disinfected in the PM room. The tertiary container is often a plastic tub. Is the secondary container placed in the tertiary container in the PM room or in the side office? Where is the tertiary container labelled? Is the tertiary container sometimes a white cardboard box?
    - *AHL Response:* The primary and secondary sample containers for tissues are sealable bags. The primary container is typically a Whirl-pak bag, and the secondary container is a biohazard bag with zip-lock seal. The tertiary container is a rigid plastic container. In this exercise, the secondary container was placed into the tertiary container at the boundary of the high-risk contaminated zone that was delineated with caution tape. During this transfer, the disinfected secondary container (held by the technician with a disinfected glove in the contaminated zone) was dropped into the tertiary container (held by the clean technician in the minimally-contaminated zone) at the zone boundary. The tertiary container was then labelled by the clean technician in the minimally-contaminated zone and disinfected. Cardboard is not used as a tertiary container since it cannot be disinfected.

- The carcasses and tissues go into the sealed barrels. What else goes in those barrels? Boots and aprons, some instruments, e.g., bone cutters, go into a disinfectant bath. Would these then be ready for re-use? What happens to lab coats, coveralls? Are these bagged until test results come in? If so and if the results are positive, what happens to the bagged materials? Is there a disinfection procedure? What happened to all the supplies that were removed from the table by the phone behind the PM table?
    - *AHL Response:* In the event of a confirmed positive FAD case, such as ASF, AHL would consult and coordinate with CFIA on the destruction, disposal and disinfection of the carcass and contaminated materials. Carcass and tissue remains are held in the sealable barrels until the results are known. The AHL Thermal Tissue Digester would likely be the most suitable method of destruction of the carcass and tissues. PPE (e.g., aprons, gloves), disposables (e.g., paper plates, sample containers), and instruments are immersion-disinfected in tubs of disinfectant. Some PPE, such as plastic aprons and the instruments, would eventually be available for use after the required contact time in disinfectant had elapsed and the routine cleaning procedures had been completed. Lab coats and coveralls, and other supplies such as boxes of gloves etc., are sealed in garbage bags and held until results are known. If positive, these materials would be disinfected by immersion in tubs of disinfectant.
- The pathologist is responsible for ensuring that personnel have completed the log sheet and that they have received a copy of the self-quarantine document. The pathologist can refer to the log sheet to see names that are listed but will they know or remember the names of those that do not complete the log sheet?
    - *AHL Response:* The pathologist is responsible for ensuring personnel complete the log sheet and receive a copy of the self-quarantine document. The PM technicians will also be aware of who was in the PM room since they oversee and monitor the exit procedure. However, if there are many people in postmortem it may be possible to overlook someone who did not fill out the log sheet. There is a camera installed in the exit area of the PM room, but it is not clear how much data it records. This will be investigated (see Action 11).
- Have any of these items in Objective 10 occurred with the current AI situation? Presumably these steps are not necessary because all potential for contamination is prevented at the front door through AHL's current policy of not receiving carcasses for PM. Birds are simply swabbed and then sent to disposal.
    - *AHL Response:* The items under Objective 10 include: The AHL Director, or designate, will provide ongoing liaison with CFIA, OMAFRA, OVC Pathobiology Chair, University of Guelph Campus Control Group to:
        - Determine whether partial building quarantine or road closure is required;
        - Determine whether to contact potentially exposed personnel who did not undergo decontamination;
        - Provide contact information of potentially exposed personnel to regulatory agencies if requested;
        - Determine when the postmortem room can re-open;
        - Determine when personal belongings in the PM room can be returned; and
        - Determine timing and method of disposal of the FAD suspect carcass, tissues, contaminated waste and sharps, and contaminated PPE.

      With the current AI situation, building quarantine or road closures have not been required. Enhanced biosecurity measures for receiving and handling potential HPAI submissions have mitigated the risks of exposing AHL personnel or contaminating the lab, allowing the AHL to maintain operations during the outbreak.

Action items arising from the exercise:

Action 1: Clarify exit instructions for low-risk and high-risk contaminated personnel, including handling and disinfecting valuables such as eyeglasses and jewelry.

Action 2: Ensure disease alert signs are visible and securely attached to entrances.

Response 2: **Action Closed** (Brooks, April 10, 2022). New Velcro-type adhesives are used to secure the disease alert signs to entrances.

Action 3: Add instruction to immersion disinfect disposable contaminated items such as gloves, paper plates, sample containers etc., prior to bagging and securing in sealable barrels.

Action 4: Add instruction to request a receipt of message to the notification alert emails sent to OMAFRA and CFIA.

Action 5: Clarify instructions for disinfecting office spaces in the postmortem room. Investigate plastic covers for computers and other sensitive equipment to minimize contamination.

Action 6: Have a list of phone numbers for OMAFRA veterinarians available to aid notification phone calls.

Action 7: Confirm email addresses in the notification listserv match those in the AHL-OMAFRA-CFIA-OMH Animal Health Incident Reporting Protocol.

Action 8: Test the wastewater disinfection process using the Thermal Tissue Digester

Action 9: Invite a biosecurity expert from CFIA to attend the next FAD exercise.

Action 10: Include the scenario of how to handle other ongoing or pending postmortems to the next exercise.

Action 11: Investigate the video camera in the PM room exit area to determine what data is recorded. Investigate whether additional video surveillance is required in the PM room to identify exposed personnel.

AHL-Kemptville - Foreign Animal Disease Exercise – Postponed

The 2022 emergency exercise at AHL-Kemptville, initially scheduled for March 2022 (handling of a HPAI suspect through swabbing and containment within the truck bay), was postponed due to unplanned staff shortages for available external auditors, as a result of both field deployment of regional CFIA veterinary officials in the current national HPAI outbreak and the ongoing COVID-19 pandemic. FAD exercises require trained and informed CFIA and/or OMAFRA observers in order to evaluate the success of the emergency simulation, and to provide valuable feedback used to improve AHL's response to an actual emergency event. The postponed exercise will be conducted at the earliest convenience following resolution of staff shortages.

5.3.6 Emergency Response – After Action

AHL continued to support the Ministry effectively, carrying out responsibilities under the emergency simulations through the development of new tests required to address urgent incidents and improve response capability in the future. Additionally, AHL provides responses to serious food safety events using existing testing methods, as well as working to improve response capabilities in the future.

The Ministry will evaluate AHL's response to, and management of, significant, unanticipated, or urgent situations or events of animal health emergencies. This includes any requirement for the development of new tests or test methods, against criteria, including timeliness, effective diagnoses, communication of test results

monitoring and reporting. Areas of improvement are identified by the Ministry and the University in response to evaluation. The target is that 100% of action requests meet implementation targets set by the AHL PMC.

In 2021/22, the Avian Influenza outbreak in Ontario required a significant and co-ordinated response by multiple laboratory sections of AHL, including Administration, Sample Reception, Avian Postmortem, and Virology. In January 2022, AHL prepared for the expected outbreak by revising and updating the AI Outbreak Response Plan. This plan details AHL internal operations during an outbreak, in addition to outlining interactions with CFIA, the agency responsible for submitting samples for AI testing. Also in January 2022, AHL Veterinarians and Supervisors met with CFIA staff to review joint operations, expectations, and contact information. These emergency preparedness activities enabled AHL to respond rapidly and effectively to the requirement for surge testing during the outbreak. For the first few weeks of the outbreak, AHL Veterinarians and Supervisors met daily at 10:00 to review issues, bottlenecks, and opportunities for improvement. As required to meet the rapid turnaround time expected for outbreak testing, Virology Technicians, Supervisors, and the Virologist worked many evenings and weekends when requested by CFIA. Despite the challenges posed by staff absences related to the COVID-19 pandemic, AHL was able to meet surge AI testing requirements, in addition to maintaining business continuity for other livestock industries.

Before the provincial outbreak alert on March 21, 2022, OMAFRA requested a description of the feasibility of enhanced surveillance initiatives by AHL, by employing routine laboratory submissions to test for the emergence of highly pathogenic H5N1 influenza. AHL responded by contacting avian veterinarians for formal permission to perform Avian Influenza PCR tests on all birds submitted for postmortem, and on all swabs submitted for IBV testing. These enhanced initiatives were implemented from early April 2022 until May 31, 2022; the foregone revenue for these approximately 800 tests totalled $29,200. OMAFRA supported AHL's enhanced surveillance initiative by providing Canadian Agricultural Partnership funds of $25,000 in March 2022 for Avian Influenza viral extraction kits used for PCR testing.

The ongoing Avian Influenza outbreak demonstrates how AHL continues to engage in effective scanning surveillance for animal health risks and is prepared to mount a successful emergency response to a major incident.

5.4 Reporting Requirements

5.4.1 Biennial Client Satisfaction Survey

The Biennial Client Satisfaction Survey information is provided in Section 5.3.1.

5.4.2 Emergency Simulation Exercise and Response Report

Reporting on the annual simulation exercise conducted at the AHL and response evaluation is provided in Section 5.3.5.

5.4.3 Emergency Response - After Action Report

The Emergency Response – After Action report is provided in Section 5.3.6.

5.4.4 OAHN Reports

The OAHN expert networks report annually at the AHL PMC meetings. They are archived with meeting minutes and are available on request.

5.4.5 OAHN Projects

Each of the ten OAHN expert networks can apply for approximately $25,000 annually to conduct a project on an identified gap in surveillance in their commodity. Table 5.16 lists the eleven OAHN Projects funded in 2021/22, totalling $133,403. Results of some of these projects were presented at various industry meetings, published in journals, and posted on the OAHN Projects webpage.

Table 5.16: 2021/22 OAHN Projects

Network	Project Title	Date Awarded	Principal Investigator	Amount
Bees	Publishing the results of the OAHN Bee network research project surveillance on resistant varroa destructor mite population to synthetic acaricides in Ontario - in a peer reviewed journal	2-Jul-2021	Paul Kozak	$5,000
Bees	Communication and design assistance for the Ontario Varroa Monitoring Campaign	20-Aug-2021	Paul Kozak	$3,488
Bees	Refining the standard bioassay method for detecting resistance in populations of varroa mites by acute toxicity	21-Aug-2021	Ernesto Guzman-Novoa	$4,086
Bovine	Trace mineral monitoring in beef cattle herds	21-Sep-2021	Jessica Gordon	$33,905
Equine	OAHN equine network webinar series	1-Mar-2022	Memo Arroyo	$3,300
Poultry	Development of a response plan for effective infectious laryngotracheitis outbreak management in Ontario	14-Mar-2022	Lucica Rosca	$19,572
Small Ruminants	Investigation of pooling serum samples for maedi visna testing	1-Mar-2022	Rex Crawford and Cathy Bauman	$4,582
Small Ruminants	Investigation of gastrointestinal nematode parasitism on Ontario goat farms	1-Apr-2022	Emma Borkowski	$4,923
Swine	CanSpot ASF submissions and communications	2-Jan-2022	Tim Pasma	$1,017
Wildlife	Muskrat health and disease surveillance	1-Feb-2022	Claire Jardine	$20,560
Wildlife	Botulism test development	1-Mar-2022	Claire Jardine	$33,000
Total				**$133,403**

5.4.6 OAHN Communications

During 2021/22, AHL continued to facilitate an integrated and collaborative disease surveillance system in Ontario, through OAHN.

Objectives of the Ontario Animal Health Network Strategic Plan are:

- Provide a communications hub/platform for topics concerning animal health and welfare issues within Ontario;
- Identify existing or emerging animal health and welfare issues and trends; and
- Contribute expertise to prevention, detection, and response activities.

Most networks consist of an expert from each of OMAFRA, AHL, and OVC, and between one and four private practitioners in support of disease surveillance in all of the major animal sectors in Ontario. “Clinical impression” surveys of private veterinarians are conducted quarterly by most networks, combined with AHL and private laboratory data, plus OMAFRA abattoir condemnation data, and are discussed in teleconferences of the expert networks.

During 2021/22, all networks (below), except the alternative species network, were active.

- Bees
- Bovine - also serving as the Ontario node for the national Canadian Animal Health Surveillance System’s Bovine Network
- Companion Animals
- Equine - also serving as the Ontario node for the national Canadian Animal Health Surveillance System’s Equine Network
- Fish - also serving as the Ontario node for the national Canadian Animal Health Surveillance System’s Aquatic Animals Network
- Poultry - also serving as the Ontario node for the national Canadian Animal Health Surveillance System’s Poultry Network
- Small Ruminants - also serving as the Ontario node for the national Canadian Animal Health Surveillance System’s Small Ruminant Network
- Swine – also serving as the Ontario node in the Canadian Swine Health Information Network (CSHIN)
- Wildlife, in collaboration with the Canadian Wildlife Health Cooperative (CWHC)
- Alternative Species/Fur-Bearing Animals – inactive due to decreased activity within these industries

The majority of networks met on a quarterly basis in 2021/22 for communication and information sharing. The exceptions included the bee network, which meets twice annually (working groups of the network meet more frequently on specific topics), the small ruminant network (meeting every six months this year), and the alternative species network, which did not meet due to industry slowdowns in recent years.

Meetings were held every three to six months with OMAFRA co-leads to share and participate in educational programing to enhance network functionality. As well, each of the OMAFRA network co-leads provided a summary of activities at the OAHN Annual General Meeting. The OAHN coordinator also provided quarterly updates to the OAHN Admin Team on OAHN activities, as well as providing financial reporting as requested to the AHL PMC.

The OAHN website has both a public/producer side and a password-protected veterinary side. Documents on the public side, such as quarterly producer/owner reports, are freely accessible on the web. Quarterly veterinary reports are posted on the private side of the website for veterinarians and registered veterinary technicians (RVTs) to access.

Page views on Ontario Animal Health Network website totaled 43,710, with 208 new registered users in 2021/22. OAHN newsletter subscribers include 901 Ontario veterinarians, 220 other veterinarians and RVTs, and 1,500 subscribers in total (down from last year, as staff scrubbed each list for organization, tested emails to ensure they were current, and verified each and every subscriber). There were 170,000 social media post impressions (104,000 - Facebook, 66,500- Twitter), six new podcasts, and 3,800 podcast listens. Resources and reports created by the networks were viewed more than 17,000 times on the website. Veterinary medical listservs have been used throughout the year, with more than 180 subscribed veterinarians.

Selected impact statistics are:

- 350 downloads of the Infection Prevention Control guidelines (600 page views);
- 2,000 page views of OAHN infographics;
- 3,000 page views of equine-related resources;
- 5,000 page views for companion animal-related resources;
- 2,000 page views for avian influenza related resources;
- 9,500 Engagements over Twitter/Facebook (clicks, comments, likes);
- 3,500 views on YouTube; and
- 150 new Instagram followers.

Integration with National Surveillance

OAHN contributed to the Canadian Animal Health Surveillance System (CAHSS), which is a 'network of networks', in the following ways:

- Dr. Maria Spinato (AHL) is a member of the CAHSS Steering Group and Dr. Tanya Rossi is a Network Observer.
- Both OMAFRA and AHL participated in various CAHSS committees – swine, poultry, equine, bovine, web development, infectious disease reporting, vector-borne diseases – that are under development, and are discussing next steps.
- OAHN Network coordinator communicated with other provincial surveillance networks every two months throughout the year.

5.4.7 KTT and Learning Opportunities

AHL continues to engage in committee and scientific meetings, which contributes to increased knowledge and expertise and a One Health approach to animal health.

The KTT and Learning Opportunities reported below illustrate the knowledge and expertise gained by AHL staff throughout the 2021/22 year. The measure for the reporting requirement includes the number of opportunities for engagement and knowledge transfer that took place during the year.

AHL maintains a record of staff participation in national and provincial committees and scientific meetings. It includes information regarding officer roles in these organizations held by staff. Two international organizations are included (American Association of Veterinary Laboratory Diagnosticians and the American College of Veterinary Pathologists), as participating in these organizations contributes to international and thus national policy. This tabulation is otherwise limited to national and provincial bodies or committees to which AHL veterinary staff members belong. Many AHL staff are also regular members of various international organizations and local organizations, which have not been included.

Participation in the large number of provincial and national veterinary organizations provides an opportunity to interact with both private practitioner colleagues, as well as industry, and brings a laboratory perspective to the issues of the day that impact or inform policy development. OMAFRA representatives are usually present at these meetings as well, and both AHL and OMAFRA staff participate in and share information within all of the OAHN expert networks.

KTT and Learning Opportunity Highlights

- 16 of 20 AHL veterinarians/supervisors participated in 159 meetings of 30 international and 129 national organizations (total 627 hours) and participated in 125 meetings of 20 provincial organizations (total 291 hours).
- All 20 AHL veterinarians/supervisors participated on federal and/or provincial animal health strategy committees and 18 attended meetings or conferences for these committees in 2021/22.
- AHL had an average of 43.1 meeting hours per year spent on relevant committees per staff member, equivalent to 2.5% of available personnel time (4.8% in the previous year; some reduction due to cancelled meetings still related to the COVID-19 pandemic).
- Veterinarians/supervisors attended two court appearances, had 22 publications, 20 peer-reviewed articles, 40 scientific newsletter articles, 12 oral presentations, four poster presentations, and provided three tours of AHL.
- Quarterly AHL Newsletter published ten Ruminant, eight Swine, ten Avian/Fur/Exotic & Fish species, six Equine, eight Companion Animal articles, as well as 21 general/updates /announcements/OAHN items in 2021/22.

Participation in the Canadian Animal Health Surveillance Network (CAHSN) has been most useful in helping to train and equip the AHL staff to deal with a foreign animal disease event at an enhanced level of preparedness, also a key requirement of the OMAFRA-UofG Agreement. AHL and OMAFRA exchange and integrate information from many sources through vehicles such as OAHN, and hence serve as a cornerstone for the larger Ontario Animal Health System and related public health bodies.

Cross-Canada representation is gained through participation in the Canadian Animal Health Laboratorians Network (CAHLN) annual meeting. The 20th CAHLN meeting was held virtually from Calgary, AB on June 7 to 9, 2021.

This meeting included participants from national, provincial, and university-based laboratories, in addition to industry representatives serving these organizations. Other annual meetings held concurrently were the Canadian Association of Veterinary Pathologists (CAVP), the Canadian Animal Health Surveillance Network, and the Transmissible Spongiform Encephalopathy (TSE) Lab Network.

AHL staff members are also regular participants at numerous conferences, e.g., the Ontario Veterinary Medical Association (OVMA) and Ontario Association of Veterinary Technicians (OAVT) annual conferences, as exhibitors, guest speakers, and/or expert panel members. Dr. Fairles (supported by Ms. Josie Given and Ms. Rina Pigozzo) actively markets the services of AHL and is in regular contact with clients. The AHL was not involved in either of these events in 2021/22 due to cancellation of in-person conferences during the COVID-19 pandemic.

5.4.8 New Tests and/or Method Development

New tests and methods are developed and/or adapted in response to industry needs, as approved by the AHL PMC. Table 5.17 provides, for 2021/22, a list of the new tests developed, the adoption of tests developed by other laboratories and any AHL PMC approved in-year modifications to tests and methods.

Table 5.17: New or Improved Tests in 2021/22

Test Name - Method	Code	Species
Bovine adenovirus sequencing	badvseq	Bov, Ov
Bovine viral diarrhea virus/Bovine adenovirus/Bovine coronavirus - PCR	bvdadco	Bov, Ov
Equine adult diarrhea PCR panel	adpcrp	Eq
Equine encephalitis virus (EEEV)/West Nile virus (WNV) - PCR	eeewnv	Av, Eq
Equine foal diarrhea PCR panel	fdpcrp	Eq
Fish Infectious Pancreatic Necrosis Virus (IPNV) - PCR	ipnv	Oth
Glaesserella parasuis - PCR	hpprt	Porc
Hemorrhagic enteritis virus, turkey - ELISA	heveli	Av, Turk
Infectious bronchitis virus/Infectious laryngotracheitis virus - PCR	ibviltv	Av, Ch
Infectious bursal disease virus/Chicken anemia virus - PCR	ibdvcav	Av, Ch
Influenza A, H1N1/H3N2 Typing - PCR	infltypv2	Av, Porc, Oth
Lactococcus garvieae - qPCR	lgrvpcr	Oth
Malignant catarrhal fever - PCR	mcfpcr	Bov, Cap, Ov, Porc
Porcine circovirus 1,2,3 - PCR	pcv123	Porc
Porcine circovirus type 3 - Sequencing	pcv3seq	Porc
Serpentovirus (Reptile nidovirus) - RT-qPCR	serppcr	Oth

5.4.9 Premises Identification

The Premises Identification (PID) Number is a unique number used to register parcels of land in Ontario associated with agri-food activities with the Provincial Premises Registry. The PID is used for the purposes of tracing sample source when necessary. The PID performance indicator was converted into a reporting requirement, as approved by Executive Committee on June 2, 2021.

Premises Identification Numbers are reported as the percentage of PIDs available in the AHL database by commodity. Table 5.18 illustrates the PID results, by year and commodity, over the term of the Agreement. There has been an increase in the percentage of PIDs for three of the six commodities over the past year, with significant growth in swine and moderate growth in small ruminant and avian.

PID numbers fluctuate as new clients are added to the AHL database. While AHL Client Services staff encourage all clients to enroll and obtain a PID, compliance is voluntary and therefore, improvements in participation are largely outside of AHL's control. OMAFRA is investigating other potential avenues to increase PID use.

Table 5.18: Percentage of PIDs Available by Year and Commodity Over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23
PIDs Available - Swine	53.7%	73.6%	80.9%	**85.7%**	
PIDs Available - Cattle	11.2%	11%	11.4%	**9.7%**	
PIDs Available - Small Ruminant	4.4%	1.9%	1.9%	**4.4%**	
PIDs Available - Camelids Cervids Rabbits	0.4%	0.0%	0.0%	**0.0%**	
PIDs Available - Avian (Chicken, Turkey, Other)	0.0%	0.9%	1.1%	**1.8%**	
PIDs Available - Fish / Bees	0.0%	0.0%	0.0%	**0.0%**	

6 AGRICULTURE AND FOOD LABORATORY

The Agriculture and Food Laboratory's (AFL) vision is to be a laboratory partner of choice for governments and universities in Canada, in support of agriculture, food safety, and animal health testing. In addition, AFL is a leader in providing high-value laboratory services to the academic and private sectors in selected niche markets. AFL's mission is "Working together toward a healthier future … providing high-value analytical and diagnostic services for the agricultural, food and veterinary sectors." As part of the Laboratory Services Division, along with the Animal Health Laboratory, AFL optimizes the leveraging of services offered within the OMAFRA-UofG Agreement to other government, commercial and academic clients, while maintaining its status as a self-sustaining division of the UofG. Taking a steady path strategically, AFL continues to be the critical resource that provides the agri-food sector and the Ministry with the scientific, diagnostic, and analytical groundwork necessary to respond to emergency situations and help ensure food security in Ontario. AFL will continue to leverage both its reputation and services, determinedly contain costs, and take a targeted approach to increasing third-party revenue generation. AFL's advanced-level technological expertise will continue to differentiate it from the competition. Leveraging of AFL services benefits both AFL and OMAFRA, through means such as:

- **Efficiencies in Economies of Scale**
  Method scope expansions provide a cost-effective approach to residue detection methods in both veterinary drug and pesticide residues and allow OMAFRA to maintain current sampling intensity, while improving detection limits and increasing the number of analytes provided in the data. This supports the Food of Plant Origin monitoring program (OH0001), the Great Lakes Tributary Waters Project (GL0001), as well as Meat Inspection programs (i.e., 1045, 1002, 1001). Through accreditation for non-routine testing, these methods are also available for investigations in the Dairy Sector. In addition, expanding AFL's current expertise through projects with third-party clients allows for this new expertise and/or technology (e.g., whole genome sequencing) to be readily applied to OMAFRA programs.
- **Timely Delivery of Laboratory Test Results to Allow for Optimal Regulatory Response**
  AFL has extensive experience meeting performance indicator targets for over 20 years. Key aspects to the results reporting process ensure that a key OMAFRA staff member receives notification of any alertable results obtained by the laboratory, even beyond normal working hours.

As AFL enters the fifth year of the Agreement, insights gained by accomplishments and challenges from the past year will define future directions. Facing the need to adjust to a global pandemic while maintaining key OMAFRA programs, AFL was able to sustain regulatory and food safety initiatives, while maintaining excellent client retention and high-level service delivery to all clients.

Over the next year, AFL will continue to focus on client service excellence as a means to securing its current market share and reputation. AFL will also pursue targeted marketing activities to build revenue in identified niche areas, with the goal of continuing to build external revenues for reinvestment and sustainability. Finally, AFL will continue to develop and maintain partnerships with regulatory partners and private sector organizations to secure its role as a "laboratory partner of choice" across Canada.

Of note, the AFL was one of the food safety laboratories in Ontario that responded to a cyber attack at a large competitor laboratory, stepping up to temporarily provide testing to their clients. This allowed many food industry producers/manufacturers to maintain their food quality objectives and continue to deliver safe food across Canada. Having good working relationships with competing laboratories ensures that Ontario has the tools and ability to quickly and effectively to protect public health and safety and respond to emergencies in the agri-food sector.

6.1 Program Activities and Achievements from 2021/22

AFL is an active, contributing partner with OMAFRA in helping achieve the protection of public health and food safety, plant health, the environment, and the Ontario economy. Through the provision of in-house scientific expertise, high-value laboratory services, applied research and method development, and provincially aligned emergency response programs, AFL aims to support OMAFRA in securing public confidence in the quality and safety of the agriculture, environment, and food sectors in Ontario.

AFL accredited testing and other activities help to ensure OMAFRA receives reliable laboratory data, while supporting compliance with the regulatory standards and requirements of various Food Safety legislation e.g., Provincial Milk Act, the Food Safety and Quality Act, 2001. AFL exceeded the requirement to ensure that all "alertable" test results are reported quickly and accurately to allow rapid response by OMAFRA for situations requiring regulatory action. In 2021/22, 99.8% of all tests were reported accurately (44,360 out of 44,452). AFL also exceeded the 98% performance target in effectively communicating all actionable test results to OMAFRA.

Accreditations enable testing laboratories, such as AFL, to demonstrate their competence at producing valid and reliable results and build trust among their customers worldwide. AFL has a strong accreditation history and undergoes regular accreditation audits which help to maintain the highest degree of technical competence. In October 2021, AFL, as part of LSD, successfully underwent its biennial Standards Council of Canada (SCC) and Canadian Association for Laboratory Accreditation Inc. (CALA) audit. Every two years, AFL is audited by SCC and CALA to maintain its accreditation to the International OIE Standard ISO/IEC 17025:2017.

AFL maintains its GLP recognition by undergoing biennial Standard Council of Canada GLP audits and remains the primary GLP recognized laboratory in Canada. This recognition enables AFL to provide strong support to OMAFRA and the growers of Ontario.

AFL's method development activities are aligned with changing regulatory standards and requirements that OMAFRA faces in each of its program areas as well as ensuring access to new and improved methods in support of a variety of needs. AFL continues to improve and provide updated methods for OMAFRA in all laboratory sections. In 2021/22 the following methods were verified and are available for future testing needs:

- The customized Multiple Target Analyte (MTA) method, installed in 2019/20, was expanded in scope to accommodate more veterinary drug compounds across all species. The AFL Method Development Team continues to improve this method wherever possible. This continued to provide an enhanced meat surveillance and monitoring program for the 2021/22 testing year.
- The method for the determination of chlorate and perchlorate in milk, developed and validated in 2020/2021, is now used by Ontario goat milk producers and available to OMAFRA for any future testing needed.
- In 2021, the Method Development Team validated and implemented the multiple residue CHEM-334 Polar pesticide determination by LC-ESI-MS/MS method. This will be introduced for testing in OMAFRA's Great Lakes Tributary Waters Project (GL0001) in 2022/23 replacing method TOPS-120 and adding additional residues at no additional cost to the project. OMAFRA is considering the addition of CHEM-334 to OH0002 Fruit and Vegetable Survey in 2023/24.

In addition, MFLP-112 and MFLP-30 methods were validated by AFL and approved by Microbiology Method Committee (MMC), Health Canada and are readily available:

- MFLP-112 Detection of Listeria Species in a Variety of Environmental Surface Samples Using GENE-UP® Listeria spp. 2 (LIS 2) Method, October 2021.

- MFLP-30 Detection of *E. coli* O157:H7 in Select Foods using the BAX® System *E. coli* O157:H7 MP, November 2021.

Additionally, to meet Health Canada regulatory requirements, the Microbiology Method Development Team expanded the scope of several microbiology methods to include cannabis as a sample type.

All laboratory sections continue to identify and implement advances in testing and technology. OMAFRA can then design their laboratory programs to incorporate the advances that most benefit their surveillance and monitoring programs and annual baseline studies.

AFL organized a half-day discussion with OMAFRA colleagues on microbial methodology advances in May 2022. This highlighted emerging testing techniques that can add value for OMAFRA to the data produced by the laboratory.

AFL also completed several OMAFRA baseline studies including:

- Pilot Project - Beef Carcass Process Verification Pilot - E. coli Tracking Project #5023 began in January 2021. The work on this pilot project continued through 2021/22 and into 2022/23. It is expected to conclude by the end of 2022. The purpose of this study is to evaluate the effectiveness of an ongoing program that would enumerate indicator organisms on beef/veal carcasses at “postchill”.
- AFL officially launched a cannabis testing service September 1, 2021. The year following this launch was expected to be slow due to complications posed by the pandemic, and challenges faced when breaking into a new market sector. Though terpenes analysis in cannabis is not one of Health Canada’s regulatory requirements, the addition of terpene methodology in various cannabis matrices was identified as a must-have to meet the needs of this market. This is currently underway in the Chemistry Section.

All laboratory sections continue to identify and implement advances in testing and technology. OMAFRA can then incorporate the advances that most benefit their surveillance and monitoring programs and annual baseline studies.

Collaborative research and other projects also expand services available to OMAFRA. Analysis for the development and the expansion of the composition test panel delivered to the Dairy Farmers of Ontario (DFO) demonstrates AFL’s commitment to OMAFRA to support any program issues that may arise periodically in this industry. AFL is pleased to be entering another contract extension with DFO and the Ontario Dairy Council (ODC), processing approximately 750,000 samples annually.

AFL staff provide high-value, impactful scientific support to OMAFRA. They are actively involved in Knowledge Translation and Transfer (KTT) activities, completing research projects, and publishing in peer-reviewed journals. This instils public confidence in AFL and ensures that it remains on the cutting edge of new developments in laboratory research and testing. A full list of KTT activities is provided in Appendix D. A few key examples are included below:

Journal Publications

1. Justin M. Renkema, Wendy McFadden-Smith, Shu Chen. Semi-quantitative detection of *Drosophila suzukii* (Diptera: Drosophilidae) from bulk trap samples using PCR technology. Journal of Economic Entomology. 2022, 1–9. https://doi.org/10.1093/jee/toab258.

2. Dele Ogunremi, Ruimin Gao, Rosemary Slowey, Susan Nadin-Davis, Shu Chen, Olga Andriesvakaia, Sadjia Bekal, Jane Parmley, Lawrence Goodridge, Roger C. Levesque. Tracking *Salmonella enteritidis* in the genomics era: clade definition using a SNP-PCR assay and implications for

population structure. Book Chapter, IntechOpen, Oct 14, 2021. https://www.intechopen.com/chapters/77305.

Research Projects (Grants) and Proposals

1. Shu Chen (PI), Team members: Susan Lee, Saleema Saleh-Lakha, Carlos Leon-Velarde, Mythri Viswanathan, Nicola Linton. Comprehensive evaluation of a high throughput culture-independent diagnostic test (CIDT) against standard methods for simultaneous detection of common food-borne pathogens in foods. Proposal submitted to Ontario Agri-Food Research Initiative Program (OMAFRA). December 2020-present.

Highly Qualified Personnel (HQP) Training

1. AFL scientific staff participated as committee supervisors, project advisors and/or provided training for six University of Guelph advanced degree candidates.

Other

1. Melody Melzer. The Canadian Phytopathological Society 2021 Photo Contest award (1st prize, Microscopic Plant Pathology category). 2021.

AFL works with stakeholders and external groups, such as DFO, to protect industry competitiveness in Ontario. AFL continues to provide and respond to emerging information on new methods of interest to the dairy sector (e.g., chlorate/perchlorate detection in raw milk (cow and goat), increase in laboratory capacity for testing).

By prioritizing advanced technology and instrumentation, as well as added capacity and expertise, AFL remains well positioned to respond to all of OMAFRA's needs. These include: urgent or emergency situations such as the COVID-19 pandemic; food-borne pathogen outbreaks and investigations (STEC testing protocol, replacement of PFGE with WGS); verifying on-site HACCP measures in meat plants; detection of newly developed pesticides (current list includes more than 700 compounds); or off-label veterinary drug use (MTA meat method, dairy samples). For over twenty-five years, AFL has consistently met testing and service performance measures including those outlined in the Agreement.

COVID-19

AFL returned to full operational status in September 2021. Throughout the pandemic, AFL continued to provide comprehensive and successful management of activities while maintaining services essential to the release and sale of safe food and beverages in Ontario. It is anticipated that the pandemic and various public health measures will continue over the coming two to three years. Incident Management Program (IMP) communications will continue to occur with OMAFRA and other clients as necessary. Significant planning for business continuity and the prioritization of food safety testing are ongoing.

AFL continued to receive fewer samples from OMAFRA and other clients during 2021/22. It is anticipated that sample numbers will approach pre-COVID numbers in 2022/23. Should COVID-related staffing reductions at the AFL reoccur, the planning previously put in place will be reinstated and OMAFRA's top priority projects will be maintained to the highest extent possible. Routine monitoring projects for meat, dairy, foods of plant origin, and agricultural development programs will be maintained to the extent that AFL's reduced capacity allows.

Raw milk testing for cow and goat milk is a service essential to the continued sale of milk in Ontario. AFL continued full testing capacity for milk producers, while supporting this regulatory requirement and maintaining on-call and after-hour confirmation of positive milk loads identified in field testing.

Because of the continued impacts of COVID-19, OMAFRA collected 69% of its allotted samples in 2021/22. OMAFRA's typical five-year rolling average for successful sample collection is 94%.

Despite the on-going pandemic and changes in OMAFRA and other clients' workflows, AFL continued to meet the prioritized testing needs of OMAFRA, dairy testing for DFO, and other food safety related testing identified as essential for the continued flow of food throughout the province. AFL is proud of its staff who worked throughout the pandemic to provide essential testing, in order to support the continued supply and sale of food and beverage products in Ontario.

As a result of this extraordinary world-wide event, AFL continued to see a significant overall decline in large projects and sample numbers coming from external sources during the 2021/22 fiscal year. This is entirely attributable to COVID-19 which continued to affect many external clients. With the declining impacts of the pandemic, revenues are anticipated to increase in 2022/23.

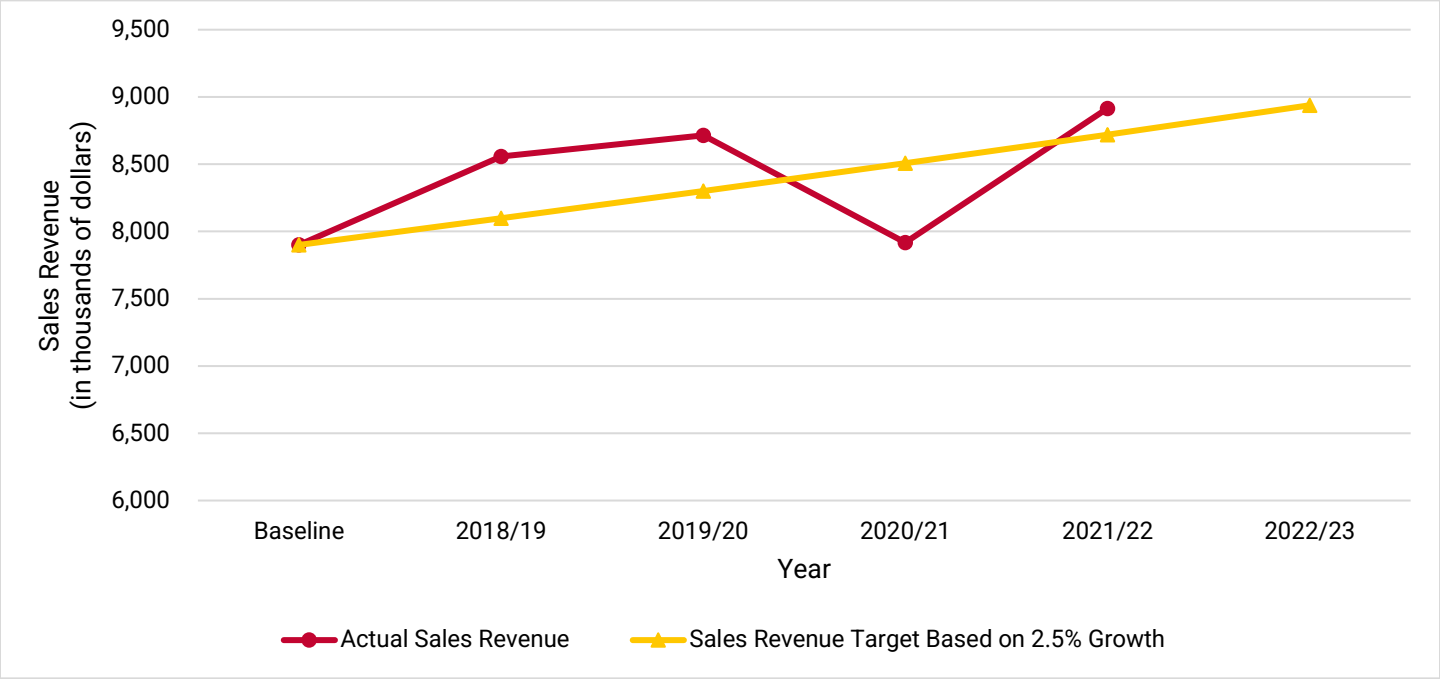
6.2 Mandatory Compliance Requirements

6.2.1 Increase in Revenues

AFL achieved third-party revenue of $8.915M in 2021/22, a 12.6% growth over the previous year's revenue of $7.917M, which was impacted significantly by the global pandemic. This surpassed the required 2.5% growth target and puts AFL on track to exceed the cumulative sales revenue target based on growth of 2.5% per year since the beginning of this Agreement. This is shown in Figure 6.1. Barring any resurgence of pandemic restrictions, AFL predicts sample and test numbers from all sources will return to pre-COVID levels in 2022/23 and the revenue target will be achieved again.

In the coming year, AFL will continue to leverage its opportunities for growth in pesticide GLP testing, microbiology, agricultural soil, and plant disease testing. Continuing the strategy of identifying niche market opportunities and applied research projects with industry and government partners are vital elements of the growth strategy. AFL will also maintain aggressive cost reduction strategies. Sustained success for AFL continues to rely on increased and diversified revenues from third-party organizations.

Figure 6.1: Actual AFL Sales Revenue over the Term of the Agreement Compared with the 2.5% Growth Target



6.2.2 Emergency Response Plan and Surge Capacity Plan

AFL has an Emergency Response Plan and a Surge Capacity Plan in place. Each is comprehensive and ensures that AFL can fulfill the objectives of the Program Schedule. The Plans outline business continuity procedures in the event of critical infrastructure outages, staff unavailability, pandemic, facility inaccessibility/evacuation, or a surge in service requirement. The Emergency Response Plan continues to be used to respond to the emergency measures, implemented in Ontario in March 2020, in response to the COVID-19 pandemic. AFL can rapidly mobilize a comprehensive and successful IMP as needed, maintaining services to clients essential to their businesses and to the release of safe food and beverages in Ontario. This plan allowed continuation of the majority of services provided by AFL, while also managing 100% of dairy samples during the pandemic.

6.2.3 Emergency Simulation Exercises

Emergency Response procedures at AFL have been developed to mirror the OMAFRA Emergency Response program. The IMP is aligned with OMAFRA to further protect OMAFRA's need for continuity in Laboratory Services in difficult times. AFL is committed to ongoing development in the areas of staff training, continuous updating and improving the program, and documentation.

Although no formal exercises were performed in 2021/22, testing interruptions from COVID-19, and sporadic maintenance issues, required AFL to regularly communicate and adapt testing situations with OMAFRA.

6.2.4 Capacity Strategy Plan

To address requirements for expertise in existing and emerging areas, AFL maintains a staff complement with advanced scientific training, develops in-house knowledge and skills, and provides further education and experience opportunities where feasible. By maintaining very high-quality testing and program delivery, including emergency preparedness, AFL Program outcomes are achieved, thus ensuring that these services continue to meet the changing needs of the agriculture, food processing, horticulture, and plant health sectors in Ontario.

The fluid nature of how contracts are awarded, and samples are received requires trained and flexible teams to be ready to shift quickly where support is needed. To help facilitate this, cross-training that allows multiple technicians to work on different projects on a rotating basis is essential. This expands the skill base of the technical group while ensuring adequate back-up resources for testing. This is particularly important to ensure continuity of on-time delivery of results for OMAFRA's surveillance programs that require rapid turnaround times from submission to reporting (e.g., MTA veterinary drug residue testing).

In 2021/22, two key people retired from AFL, the Director of AFL/Co-Executive Director of LSD and the Director, Financial Operations. Dr. Rafikali Momin, an experienced leader and laboratory sciences expert, was named the new Director of AFL/Co-Executive Director of LSD as of April 18, 2022. Mr. Naveed Kanji was hired as the Manager of Financial Operations effective January 31, 2022.

In general, AFL does not anticipate the creation of new positions in 2022/23 without significant revenue increases. The current staffing level will be maintained, staffing structures may be realigned for more efficient operation, and succession planning and mentoring of senior staff will continue to allow achievement of the overall Agreement objectives and commitments in the coming year and beyond.

Some additional professional staff turnover is anticipated in 2022/23, with plans in place to fill key positions (from within) with trained individuals as part of AFL's succession planning. In addition, AFL expects to

continue to experience high turnover with entry-level laboratory assistant positions in both the Chemistry and Food Microbiology sections. As a result, vacancies often exist within laboratory operations while moving through the re-hiring process. No new priority areas or emerging issues for the Ministry are known at this time.

6.2.5 Capital Strategy Plan

As outlined in the AFL section of the Business Plan, a capital expenditure program (CAPEX) has been a longstanding strategy of the Laboratory Services Division. Equipment and instruments are closely monitored, identifying requirements for repair or replacement. Also, the need for additional equipment for testing to support new methods is considered.

Computer hardware and software are replaced on a planned basis in order to keep pace with the management of increasing volumes of data. Some investments in information technology have been identified for 2022/23.

Ongoing support from OMAFRA's Capital Expenditure Fund, which provides direction and funds annually for equipment purchases, is a critical part of the capital strategy given the challenges in securing external revenue for reinvestment. Over the years, OMAFRA's capital investment of $500K has funded the replacement of ageing instruments integral in the support of OMAFRA's programs. In 2021/22, this investment was used to support the Dairy program and replaced a Milkoscan/Somatic Cell Counter instrument that was beyond expected lifespan. Ministry support for the second end of life Milkoscan/Somatic Cell Counter instrument will be requested in 2022/23.

Other equipment purchases required for the ongoing support of OMAFRA programs and third-party client needs are funded from operating income in excess of budget and from program carry forwards.

6.2.6 Resources and Capacity to Administer AFL

The University confirms that it has the necessary resources, including technical and support staff to administer AFL. As mentioned above, Dr. Rafikali Momin joined AFL as the new Director in April 2022, replacing Dr. Linda Lissemore. Dr. Lissemore provided exceptional leadership while she was at the helm of AFL. It is anticipated that Dr. Momin will continue to provide outstanding leadership and support of the governance structure as an AFL PMC Co-Chair.

With the guidance of Dr. Momin and the Manager of Financial Operations, Mr. Naveed Kanji, the AFL Program is supported by four operational managers: Dr. Shu Chen, Mr. Andrew Moore, Ms. Cassandra Schoen, and Mr. Andrew Harris. In addition, Ms. Karen Peer, Executive Assistant, Ms. Liz King, Quality Assurance Manager, Ms. Lynne Fruhner, OMAFRA Agreement Manager and Ms. Pauline Nelson-Smikle, Information Technology Manager, also play critical roles in supporting the program. Together, they lead AFL's complement of 137 supervisory, support, and technical staff.

AFL cross-trains within a discipline, as much as possible, to allow for leveraging of skills for OMAFRA and third-party testing. This approach protects the organization from the risk of losing specific skills through staff turnover. Table 6.1 provides the highest degree earned for AFL's staff complement.

Table 6.1: 2021/22 AFL Staff Complement by Highest Degree Earned

Doctoral (e.g., PhD)	Advanced (e.g., MSc)	Undergraduate	Other	Total
10	26	56	45	**137**

The flexibility afforded in using cross-trained technicians and/or adding temporary positions, in cases of sudden or short-term capacity demands, allows AFL to meet OMAFRA's needs when additional testing is

required beyond the annual testing plan. Each case is considered individually and includes an assessment of its impact on delivery of the annual testing plan.

6.2.7 Annual Summary of the ISO/IEC 17025 Accreditation Report

LSD, including AFL, is accredited by both of Canada's internationally recognized accrediting bodies, the Standard Council of Canada (SCC) and the Canadian Association for Laboratory Accreditation (CALA) to the ISO/IEC 17025 standard, for specific tests listed on the scopes of accreditation. LSD is accredited by SCC in two program specialty areas:

- Agriculture Inputs, Food, Animal Health and Plant Protection (AFAP); and
- Test Method Development and Evaluation and Non-Routine Testing (TMD/NRT).

In addition, the AFL is recognized as a GLP test facility/test site by the SCC.

Based on the April 13, 2022, SCC scope document, LSD has 106 accredited tests and 21 accredited techniques listed, 88 AFL tests with 15 techniques and 18 AHL tests with 6 techniques. For a method to be accredited, competence must be demonstrated by submitting the method, forms, training records, validation/verification records, proficiency testing results and an internal audit report to SCC for inspection. SCC will conduct their next biennial audit of LSD in Fall 2023.

Since June 2021, AFL removed accreditation for two tests: *MID-226 Detection of Listeria Species from Environmental Surfaces Using the BAX® System Genus Listeria Assay* and *MID-269 Detection of Top 7 O-serogroups Shiga toxin producing E. coli in beef by BioControl Assurance GDS® MPX Top 7 STEC method* and added accreditation for the following six tests:

- CHEM-061 Charm® II Amphenicols test for milk;
- CHEM-334 Polar pesticide determination by liquid chromatography/electrospray ionization-tandem mass spectrometry (LC/ESI-MS/MS);
- CHEM-337 Veterinary drug residues in foods of animal origin by LC-MS/MS;
- DA-109 Milk urea nitrogen (MUN) in milk by infrared milk analyzers (infrared method);
- MFLP-79 Detection of *Listeria* spp. in Environmental Surface Samples Using the BAX® System Real-Time PCR Assay for *Listeria* Genus (MID-291); and
- MFLP-86 Identification of *vt1* and *vt2* genes from Verotoxigenic *Escherichia coli* by Polymerase Chain Reaction (MOL-253).

Based on the current CALA scope, AFL is accredited by CALA for eight environmental tests (eleven CALA appendices) – one molecular test, three chemistry pesticide tests, one soil and nutrient test, and three microbiological tests. The three CALA accredited microbiology tests are also licensed under the Ontario Safe Drinking Water Act (OSDWA).

Schedule D – Accreditation

In 2021/22, under Schedule D, AFL provided testing services for three programs within the Food Inspection Branch. The majority of these tests are accredited to the ISO/IEC 17025 quality standard. Table 6.2 below summarizes the accreditation status of tests used for OMAFRA's Food Inspection Branch. Note that some methods are used to analyze multiple parameters (e.g., CHEM-337 MTA is used to analyze samples for multiple drug classes).

Table 6.2: Accreditation Status of Tests used for OMAFRA Food Inspection Branch

Branch	Number of Tests	SCC accredited	CALA accredited
Meat Inspection Program	22	17	2
Dairy Food Safety Program	39	29	2
Food of Plant Origin Program	31	18	1
Total	**92**	**64**	**5**

In addition, AFL performs 48 tests for Horticulture and Agriculture Land Use program and Environmental Management program, 12 of the tests are accredited by SCC, CALA or OMAFRA soil fertility program.

6.2.8 AFL Program Sample Testing Data

Quarterly reports are provided by AFL to OMAFRA demonstrating compliance with the performance indicators assigned to sample testing data. AFL and OMAFRA have integrated their information management systems to allow for seamless transfer of data between organizations. Please see Section 6.3.3 for the summary of the annual performance data.

6.2.9 Changes to Methods or Testing Protocols Used in Ministry Samples

AFL acknowledges that communication to the Ministry of any program method changes is a mandatory requirement of this Agreement. Changes to methods/testing protocols within the OMAFRA program samples are verified and documented differently dependent on the required level of approvals at OMAFRA. The following verification methods are accepted by OMAFRA and AFL to enact a change:

- Authorized interface protocol document;
- Authorized memo from the Director of the Food Safety Systems Development Branch or other appropriate Branch;
- Officially distributed annual Sampling and Testing Requirements document; and
- Decisions documented in meeting minutes.

AFL remained in compliance throughout 2021/22.

6.2.10 Notifications to the Ministry

The OMAFRA Annual Sample and Testing Plan and the Sample and Testing Requirements documents provide AFL with the number of tests allocated and the methods required, as well as test result thresholds at which the Ministry wishes to be contacted. OMAFRA and AFL follow a standard operating procedure for making notifications for “alertable” results.

AFL exceeded the requirement to ensure that all “alertable” test results were reported quickly and accurately to allow rapid response by OMAFRA for situations requiring regulatory action.

While the Ministry tracks the number of samples that it has provided each quarter, AFL also tracks the number of samples received that are suitable for testing, unsuitable for testing or that have insufficient volume for testing. AFL notifies the Ministry for further direction in the case of unsuitable or insufficient samples.

AFL and the Ministry collaborate to ensure that only high integrity samples are used for Ontario’s regulatory testing program; extended ‘in transit’ times for samples can degrade their integrity. In 2021/22, the pandemic continued to impact OMAFRA’s sample delivery system. Due to COVID-19, couriers faced reduced staffing and

significant increases in the demand for package delivery. Courier company delays continued in 2021/22, although to a lesser extent.

6.3 Key Performance Indicators

6.3.1 Emergency Preparedness

AFL is prepared for future emergencies requiring laboratory services related to food, plants and the environment, and implements recommendations for improvement made by the IMS during emergency simulation exercises.

The COVID-19 pandemic has provided a real-time application of AFL's Emergency Preparedness protocols. AFL continues to meet the Ministry's requirements during the pandemic by prioritizing samples and providing ongoing services within a modified workplace.

AFL reached the target of 100% of action requests meeting implementation targets set by the AFL PMC.

6.3.2 Emergency Situations

AFL continues to successfully support the Ministry in response to, and management of, significant, unanticipated, or urgent incidence of food safety, environmental, health and plant/pest emergencies. This includes any requirement for the development of new tests or test methods and against criteria including timeliness, effective diagnoses, communication of test results, monitoring and reporting of test results, monitoring and reporting of surveillance data, and participation with stakeholders. AFL is at the ready to appropriately carry out its responsibilities under Emergency Situations to support the Ministry effectively through: 1) the development of new tests required to address urgent incidents and to improve response capability in the future, and 2) response to serious food safety events using existing testing methods and improving future response capabilities.

Any emergency situations are reported on a quarterly basis at the AFL PMC meetings. The University was able to reach the expectation that 100% of action requests met the implementation targets set by AFL PMC.

6.3.3 High Quality Reliable Laboratory Results

Tables 6.3 to 6.5 show performance measures for the percentage of completed tests that comply with the quality and service level standards and requirements, as detailed in the Annual Testing Plan Agreement, related to turnaround times for screening and confirmation, corrected reports and samples that are unsuitable for testing. These parameters are used to assess the proportion of completed tests that meet quality, sample integrity, and service level standards and requirements. This parameter is reported quarterly at the AFL PMC meetings.

The performance measurements are the percentages of completed tests that comply with the quality and service level standards and requirements related to turnaround times for screening and confirmation, corrected reports, and samples which are unsuitable for testing. The targets require turnaround times to exceed 98% and both corrected reports and unsuitable samples for testing to be less than 2%.

The Food Safety Program (Total) and 2021/22 Summary are expressed as weighted averages. For 2021/22, there was 99.5% overall compliance for the Food Safety Program with respect to Turnaround Times, exceeding

the service standard of 98%. In 2021/22, there was 0.20% rate of corrected reports for the Food Safety Program. This exceeded the service standard maximum of 2.0%. In 2021/22, there was a 0.36% rate of samples that were categorized as "unsuitable for testing" in the Food Safety Program. This exceeded the service standard maximum of 2%. Table 6.6 shows these performance metrics over the term of the Agreement.

Table 6.3: 2021/22 Food Safety Program Compliance with Turnaround Times (98% Target)

Program	Q1	Q2	Q3	Q4	2021/22
Meat Inspection Program	99.1%	99.1%	99.8%	99.4%	99.2%
Foods of Plant Origin	100%	99.3%	100%	100%	99.8%
Dairy Food Safety Program	100%	100%	100%	100%	100%
Food Safety Program (Total)	**99.5%**	**99.4%**	**99.9%**	**99.6%**	**99.5%**
Agriculture Development Branch	100%	99.6%	100%	100%	99.6%

Table 6.4: 2021/22 Food Safety Program Compliance for Corrected Reports (Less than 2% Target)

Program	Q1	Q2	Q3	Q4	2021/22
Meat Inspection Program	0.04%	0.17%	0.41%	0.10%	0.16%
Foods of Plant Origin	0.52%	0.10%	0.00%	0.00%	0.33%
Dairy Food Safety Program	0.06%	0.12%	0.30%	0.46%	0.24%
Food Safety Program (Total)	**0.16%**	**0.15%**	**0.36%**	**0.20%**	**0.20%**
Agriculture Development Branch	0.14%	0.18%	10.00%[28]	0.00%	0.27%

Table 6.5: 2021/22 Food Safety Program Compliance for Samples Unsuitable for Testing (Less Than 2% Target)

Program	Q1	Q2	Q3	Q4	2021/22
Meat Inspection Program	0.66%	0.51%	0.41%	0.10%	0.42%
Foods of Plant Origin	0.07%	0.00%	0.00%	0.00%	0.04%
Dairy Food Safety Program	0.22%	0.15%	1.35%	0.46%	0.38%
Food Safety Program (Total)	**0.42%**	**0.34%**	**0.69%**	**0.20%**	**0.36%**
Agriculture Development Branch	0.00%	0.00%	0.00%	0.00%	0.00%

Table 6.6: High Quality Reliable Laboratory Results in the Food Safety Program over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Turnaround Times	99.6%	99.9%	99.0%	**99.5%**		98.0%
Corrected Reports	0.52%	0.22%	0.11%	**0.20%**		≤2.00%
Samples Unsuitable for Testing	0.08%	0.22%	0.26%	**0.36%**		≤2.00%

[28] The 10.00% value in Q3 for Agriculture Development Branch reflects two revisions, whose impact is magnified by the lower number of tests reported in Q3.

6.3.4 Effective and Timely Communication of Violative or Actionable Test Results

In the 2021/22 Sampling Plan, 99.8% of all tests were reported accurately (44,360 out of 44,452). The 0.2% of tests reported inaccurately would be captured in AFL's Corrective Action Preventative Action (CAPA) database, which is an effective tool for tracking performance incidents and continuous improvements. Within the database, AFL documents incidents of erroneous laboratory results, false positive or negative results, samples which are unsuitable for testing, and spoiled samples (including "OMAFRA sampler error"). All incidents are classified into one of four categories: administrative, technical, force majeure, or compliments (a new positive category tracked in 2021/22).

Table 6.7 provides a performance measure on the consistency with which AFL provided timely test results required for actionable response to OMAFRA. All incidents of inconsistency in providing, or that risk not providing, timely test results require an actionable response. Incidents are tracked in the CAPA database and reported on a quarterly basis at the AFL PMC meetings. The measurement of the performance metric is, in practice, how AFL demonstrates resulting continuous improvement activities derived from the CAPAs and compliance by documenting prevention and resolution (as available) of these incidents. The performance target is set as continuous improvement and resolution of initiatives based on review of incident reports.

Resulting continuous improvement implementation is the key factor to this performance measure. As a result of the CAPA reports, the following continuous improvement activities occurred:

- Information Technology (IT) staff improved the coding interface so that results are updated within ten minutes to allow time for quick revisions of data input errors. This will save time for both OMAFRA and AFL in not having to write, track and report a CAPA. Instead, it will correct the result more quickly.
- AFL extended training in the use of modified atmosphere gas for laboratory technicians.
- AFL improved data interpretation for the identification of tetracycline based compounds.
- The display format on a PCR instrument was changed so that all sample IDs are clearly visible.

The University was able to meet the target of ensuring continuous improvement and resolving initiatives based on review of the incident reports.

Table 6.7: Frequency of Corrective and Preventative Actions by Quarter for 2021/22

CAPA Classification	Q1	Q2	Q3	Q4	2021/22
Administrative	3	4	9	3	**19**
Technical	1	6	2	0	**9**
Force Majeure	0	0	0	0	**0**
Schedule D (Total)	**4**	**10**	**11**	**3**	**28**
Compliments	0	1	0	0	**1**

Table 6.8 shows the corrective and preventative action files by year for the term of the Agreement. Most CAPAs from the 2021/22 Schedule D were low risk. Many low risk CAPA's are administrative in nature and can be attributed to AFL and/or OMAFRA administrative activities, e.g., a data entry error. These types of incidents are flagged by the quality checks within OMAFRA and AFL's information systems and do not impact human health or organizational reputation, key criteria considered when assigning risk.

Seven medium to high risk CAPAs were thoroughly investigated and satisfactorily closed in 2021/22. These types of incidents have the potential to impact human health or organizational reputation. Out of the seven, only one medium risk CAPA affected a surveillance project, and it was resolved successfully.

Table 6.8: Corrective and Preventative Actions by Year Over the Term of the Agreement[29]

Metric	2018/19	2019/20	2020/21	2021/22	2022/23
Corrective and Preventative Actions	27	28	18	**28**	
Compliments	N/A	N/A	N/A	**1**	

6.3.5 Effective Response to Incidents

In 2021/22, AFL delivered excellence in regard to compliance with communication protocols, providing effective response to food contamination and other serious plant and environmental hazards with potentially grave human health or economic consequences.

The performance measurement is the percentage of tests requiring an actionable report from AFL that met communication criteria, Sampling and Testing Plan, or Standard Operating Procedure for adverse results notification. The performance target is set at 98% and the AFL met the performance target, with 100% compliance. All actionable results were reported to OMAFRA per 95S-028. For 2021/22, AFL's adverse result alert program generated 987 alert emails, reporting 2,178 alertable, adverse or presumptive positive test results for 1,386 samples.

The proportion of test results that are alertable, adverse or presumptive positive versus the total number of tests reported was 4.90% this year, an increase from 2.88% in 2020/21.

This parameter is reported quarterly at the AFL PMC meetings.

6.3.6 Development of New/Improved Detection Methods

The performance metric for the development of new and improved detection methods is an estimate of timelines based on a list of prioritized methods requested by the Ministry. The AFL continues to work on Phase 3 of the current OMAFRA Method Development Priority Memo (July 15, 2020).

AFL has assessed and compiled a list of available standards from both the OMAFRA Priority Memo, Phase 3: Exploratory Methods list as well as the new, proposed Health Canada MRLs list. This information is currently under review at OMAFRA, who will develop the next steps for method development and present them to the AFL in 2022/23.

This will complete the priorities listed in the current OMAFRA Method Development Priority Memo (July 15, 2020).

Progress with method development timelines is reported quarterly at the AFL PMC meetings.

[29] CAPA files may also include continuous improvement initiatives and compliments. CAPA files do not include "Corrected Reports".

6.4 Reporting Requirements

6.4.1 Summary of the ISO/IEC 17025 Report

See Section 6.2.7 for the summary of the ISO/IEC 17025 Report.

7 PROPERTY MANAGEMENT PROGRAM

The Property Management program supports the day-to-day operations and maintenance, repair and use of the Agricultural Research Institute of Ontario (ARIO) Research Centres for research and innovation that grow and improve Ontario's agri-food sector and stimulate economic development in Ontario. The University and OMAFRA have the shared goals of continuous improvement and maximized use of research infrastructure available at the ARIO Research Centres in a manner that provides benefits to all of Ontario's regions.

7.1 Program Activities and Achievements from 2021/22

The Agreement supports a network of research centres across the province that enable field-scale discovery and validation that support Ontario's agri-food sector. The centres are owned by ARIO and managed by the University of Guelph through the Agreement. When considered in combination with the University's state-of-the-art research infrastructure, ranging from controlled environment facilities to leading-edge laboratories, these places create a provincial platform for excellence in agri-food research and innovation.

Ontario's Agri-Food Research Centres enable research that is field-tested at a commercial scale. The centres are also key outreach spaces where researchers and staff welcome producers, policy makers, international visitors, students, and industry partners.

In 2021/22, there were significant infrastructure development activities under ARIO's Infrastructure Strategy. These developments are detailed in Section 7.1.1.

The University continues to support ARIO's efforts to dispose of surplus properties across the portfolio. In 2021/22, ARIO completed the sale of properties at New Liskeard, Guelph, and Woodstock, and transferred responsibility for the balance of the Kemptville property to other provincial authorities. The University looks forward to winding up Agreement-related involvement with the remaining surplus property at Alfred.

Emergency Response and Business Continuity Plan

The Property Management Program completed a comprehensive review and update of its Business Continuity Plan (BCP) in 2021/22. The revised plan was approved by R/PM PMC on February 3, 2022. The plan outlines how the research centres will continue operating during an unplanned disruption in services. The purpose of the plan is to help minimize the impact of an emergency or incident on the research centres and to allow operations to return to normal as soon as possible. The plan will be updated annually based on feedback from simulation exercises and administrative changes.

On May 11, 2022, a tabletop emergency simulation exercise was conducted at the Ontario Dairy Research Centre (ODRC) to test the BCP. The Centre Manager and Forepersons participated in the exercise. The exercise was facilitated by the Director, Research Facilities Management and the Agreement Governance Officer and was observed by a representative from OMAFRA. The emergency exercise was presented in two parts. Part one included an extended power outage at ODRC on the Friday before the Family Day weekend in February. The scenario suggested the best estimate for power restoration would be five days from the start of the outage and temperatures were predicted to range between -10 to -22 C during that time. Part two of the exercise presented that the backup generator failed after 48 hours. Overall, the goals and objectives of the exercise were met, and the participants exceeded expectations in their ability to complete a successful emergency response. The observer and facilitators were impressed with the conversation and the expertise presented by the participants. The conversation was constructive and identified a few areas of the BCP that can be improved.

COVID-19

Although the legislated response to the COVID-19 pandemic allowed for the continuation of research operations at the ARIO Locations, mitigation and safety measures continued to impact the Property Management program during 2021/22. A vaccination mandate was implemented in 2021/22 requiring all people who access the research centres to be vaccinated, unless they had a valid exemption. The University continued to limit visitor access to the centres for general interest and non-research related activities, consistent with policies in place for main campus. Towards the end of the fourth quarter, tours were welcomed back to the research centres.

It is expected that activities will continue to return to more normal levels in 2022/23, subject to the local prevalence of the COVID-19 virus.

7.1.1 ARIO Properties Infrastructure Update

UofG is working closely with its partners to execute ARIO's Infrastructure Strategy, as major construction projects are underway across the province according to the long-term research objectives of the strategy. Although funded outside of the Agreement, the implementation of the Infrastructure Strategy requires considerable allocation of UofG staff resources and impacts research capacity in the short term through construction and transition.

7.1.1.1 Major Capital

In 2021/22, work continued and, in some cases, neared completion on several major capital projects across the research centre portfolio. Major capital projects are funded and managed through project-specific Transfer Payment Agreements (TPAs) between ARIO and the University, which provide funding outside of the Agreement and have separate reporting requirements. Project summaries are included below.

Ontario Beef Research Centres – Elora and New Liskeard

The redevelopment of the Ontario Beef Research Centre (OBRC) - Elora was completed in 2021/22. The project included the construction of an expanded cow-calf facility, feedlot facility, new staff and cattle handling facilities, and the expansion and redevelopment of pasture facilities funded through the Minor Capital Program. The cow-calf portion of the project was completed in September 2019 and the feedlot facility was completed in September 2021, including the supply and installation of precision feed intake monitoring and control equipment supported by Canadian Agricultural Partnership (CAP) funds secured by ARIO. The completion of the OBRC facilities allowed for the expansion of the breeding herd housed at the OBRC – Elora and consolidated all breeding activities at one location.

The transition of the Ontario Beef Research Centre - New Liskeard to a seasonal grazing research operation commenced in 2021/22, with further upgrades anticipated in 2022/23 through the Minor Capital Program.

Precision Feed Preparation and Storage Facility - Elora

The construction of a new Precision Feed Preparation and Storage Facility was completed in 2021/22. This $9.45M facility provides new capacity for the preparation of precise and consistent research rations for the dairy and beef herds, as well as additional feed storage capacity, in anticipation of the expansion of the beef research herd due to the transfer of cattle from the Ontario Beef Research Centre – New Liskeard.

Ontario Swine Research Centre - Elora

ARIO and the University executed a $15M TPA in December 2018 for the construction of a new swine research centre at the Elora Research Station. The project budget was increased to $18.3M to account for higher than budgeted tender prices allowing construction to commence in Summer 2021. Construction will continue though 2022/23, with an estimated completion in the first quarter of 2023/24.

Guelph Turfgrass Institute

Construction of the Guelph Turfgrass Institute administration building, which replaced the existing building at the Guelph Research Station, was completed in 2021/22. This $15M project allowed the University to vacate the Guelph Research Station, as directed by ARIO, and relocate to a new site on the main campus of the UofG. The University took possession of the new facility in October 2021 and the former site was sold by ARIO in December 2021.

Ontario Crops Research Centre - New Liskeard - Agronomy Service Building

The $7.1M project to construct new agronomy research service facilities at the Ontario Crops Research Centre – New Liskeard was substantially complete by the end of 2021/22. The new facilities will allow the University to consolidate field research operations on the eastern portion of the New Liskeard property. The sale of surplus property and buildings was completed in June 2021, however the University continued to occupy Agronomy Service buildings and the SPUD unit under a lease with the new property owner.

Ontario Crops Research Centre – Ridgetown - Field Crop Service Building

Construction of the $6.5M Field Crop Service Building to support the Ontario Crops Research Centre - Ridgetown was substantially completed by January 2022. The University anticipates moving into the facility early in 2022/23, ahead of the 2022 field crop research season.

7.1.1.2 Minor Capital

Under the Minor Capital program, $4M was recovered from ARIO, outside of the Agreement, for 20 projects supporting state of good repair and program capacity improvements. An updated five-year Minor Capital program priority list was submitted to OMAFRA in December 2021 focusing on the following areas:

- Health & safety;
- Code compliance;
- Animal care;
- Building integrity;
- Life cycle replacement;
- Efficiency and conservation; and
- Program capacity (maintain or improve).

The Minor Capital program is an essential source of funds to maintain the state of good repair and research capacity (equipment and built infrastructure) at the ARIO Properties. Significant projects funded in 2021/22 include:

- Laboratory and storage cooler upgrades at the Ontario Crops Research Centre – Simcoe;
- Beef pasture expansion and redevelopment at the Ontario Beef Research Centre – Elora;
- Quarantine and isolation facility upgrades at the Ontario Aquaculture Research Centre;
- Field drainage tile replacement at Ontario Crops Research Centres at Ridgetown;

- Harvest of biomass research plots at the Guelph Research Station; and
- Supply and installation of specialty research cages at the Arkell Poultry Research Facility.

An updated five-year priority list (covering the fiscal years 2023/24 to 2028/29) will be submitted in December 2022.

7.1.2 Update on Business Plan Activities

There were several activities identified in the 2021/22 Business Plan related to the Property Management program. Table 7.1 provides a comparative summary of activities proposed in the Business Plan, relative to the activities that took place. In addition, several activities from the Research Support program activity in the Research Program have been repeated here as they are relevant to both programs.

Table 7.1: Status Update on the 2021/22 Business Plan Activities

Business Plan Activity	Status
Facility renewal - Major infrastructure upgrades under the ARIO Infrastructure Strategy, including ongoing work at a number of locations and operational transitions related to Ontario Beef Research Centre (Elora) and Precision Feed Preparation and Storage Facility (Elora)	Complete. The redevelopment of the Ontario Beef Research Centre (OBRC) - Elora and the creation of a Precision Feed Preparation and Storage Facility were both completed in 2021/22. See Section 7.1.1.1 for further details.
Centre / station utilization review and improvements, including emphasizing the importance of Tier II, III, and IV projects	In progress. A number of initiatives are underway at several locations to increase utilization. Various user groups have met over the past year to consider opportunities to improve utilization, and many transition plans are in development or being implemented at new and redeveloped facilities such as the Ontario Beef Research Centres - Elora and New Liskeard, the Ontario Crops Research Centre - New Liskeard and at the Ontario Aquaculture Research Centre.
In conjunction with the Research Program, enhancing the research platforms to cultivate new opportunities *(From Research Support)*	Ongoing. The Office of Research Agri-Food Partnership staff work collaboratively with UofG researchers to discuss ways of enhancing the research platforms to take advantage of new opportunities and/or areas of research. For example, significant work has been done at Elora and New Liskeard to enhance research opportunities in pasture and forage management and precision feed production, in light of the recently completed infrastructure upgrades at OBRC - Elora and OBRC – New Liskeard. In addition, the University continues to work on enhancing the capture, storage, sharing and re-use of data generated at Ontario's Agri-Food Research Centres.
Station naming - Rollout of the new naming and branding to improve recognition and consistency across all sites	Ongoing. New research centre names are now in use and digital channels have been updated, including the Alliance website. Select on-site physical assets, including signage, will be updated in 2022/23. Examples include updating the donor

Business Plan Activity	Status
	wall at ODRC, as well as design and installation of road-side signs.
Sustainability and efficiency considerations through Minor Capital program opportunities and operational improvements	Ongoing. The current five-year minor capital program submission includes several projects that focus on sustainability and operational improvements such as the addition of solar panels to facilities at Elora, planning for greenhouse and HVAC improvements at Simcoe, and research and operational equipment purchases that improve efficiency and capacity.
Sustaining/growing revenues, finding efficiencies and opportunities for cost containment associated with Property Management program activities	Ongoing. The focus in 2021/22 has been looking for opportunities to maximize revenue from the reorganized beef research facilities at Elora and New Liskeard, as well as planning for the commissioning of the Ontario Swine Research Centre which will transition from a closed herd to open. Managers of ODRC, OBRC – Elora, and Research Station Operations continue to work together to optimize feed production requirements to maximize available land at Elora and surrounding areas for revenue crop production.
Analyzing Research Centre use in detail to ensure all research related uses are accounted for and emphasizing the use of Tier II, III and IV project reporting in RMS for all work that takes place	In progress. The University is continuing efforts to refine processes for Tiers II, III and IV projects at the research centres. Issues related to Animal Use Protocols, scientific merit review, and research project design and implementation are currently being addressed with various University groups.
Establishing Research Centre Advisory Committees to bring together centre management and researchers to identify any barriers that may prevent new research opportunities, to support infrastructure planning and priority setting, and to address any operational issues associated with project implementation, animal care, equipment needs and staffing challenges	In progress. User group meetings have been organized at ODRC and OBRC (pasture specific) to address utilization issues and opportunities. The University expects to establish utilization focused user groups at additional sites in 2022/23.
Ensuring appropriate levels of technical capacity exist to effectively use the Ontario Agri-Food Research Centres *(From Research Support)*	In progress. A thorough review of the technical capacity within the Agreement was done in 2021/22. The University will be looking at how and where technical capacity is assigned, as part of the renewal process. A data technician was hired for the Elora Research Station, initially focusing on ODRC and OBRC. The data technician will support the newly established research data access portal, manage onsite sensors, and consider opportunities for improvements.
Continuing to develop the policies and processes for Tiers II, III and IV with the goals of improving accountability and	In progress. Policies and processes are in development for each of Tiers II, III and IV. The University has also created a

Business Plan Activity	Status
reporting capacity *(From Research Support)*	summary guide to clarify the differences between the tiers. This will be shared with OMAFRA in Summer 2022. The Tier II and III policy has been drafted and will be shared with OMAFRA shortly. The Tier IV policy was discussed with OMAFRA in 2021/22. Some adjustments need to be made, but it is expected that the policy will be approved in 2022/23.

7.2 Mandatory Compliance Requirements

None.

7.3 Key Performance Indicators

7.3.1 Research Centre Revenue

Table 7.2 provides a summary of all revenues resulting from the activities within the Property Management program, including the sales of farm products, rental revenues and recoveries for research centre/facility usage and animal purchases. Property specific information can be found in Section 2.3.5.2. In 2021/22, the five-year rolling average for all revenues and recoveries related to the Research Centres was $6,676K. This exceeded the target in the Agreement of $4,871K by 37%. This was a 3% increase from the 2020/21 five-year rolling average of $6,465K.

Table 7.2: Research Centre Revenues and Recoveries by Year (in thousands of dollars)

Metric	2017/18	2018/19	2019/20	2020/21	2021/22
Revenues (External)	**6,199**	**5,965**	**5,465**	**5,698**	**5,576**
Sales of Animals, Farm Products	4,777	4,600	4,266	4,669	4,888
Miscellaneous	102	183	215	192	240
Facility Rentals	1,319	1,182	985	837	448
Recoveries (Internal)	**786**	**893**	**963**	**758**	**1,076**
Sales (net) of Animals, Farm Products	40	151	202	101	292
Research Centre Fees	549	417	426	406	524
Facility Usage (net)	197	325	334	251	260
Total	**6,985**	**6,858**	**6,428**	**6,457**	**6,653**

Table 7.3 shows the five-year rolling average of Research Centre revenues and recoveries over the term of the Agreement. The University has surpassed the target in each of the last four years.

Table 7.3: Five-Year Rolling Average of Research Centre Revenues and Recoveries over the Term of the Agreement (in thousands of dollars)

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Five Year Rolling Average of Research Centre Revenues and Recoveries	6,518	6,444	6,465	**6,676**		4,871

Although Research Centre revenues and recoveries remain well above the target established, there has been a general decline in total revenue since the peak in 2017/18. This is mainly attributed to reductions in facility rentals revenues due to the loss of the ARIO tenant share of operations and maintenance (O&M) costs. Tenant facility rental revenues from ARIO for O&M costs are directly related to the number of ARIO tenants and the amount of space they occupy. As ARIO sells/transfers tenant-occupied properties, like New Liskeard and Kemptville, corresponding tenant facility rental revenues are also reduced. In general, however, there is no net budget impact associated with the reductions, as there is also an equal decrease in O&M cost. The University understands that the number of ARIO tenants reached the minimum at the end of 2021/22. The revenue related to facility rentals will continue to drop in 2022/23, since 2021/22 involved a partial year of occupancy, and should stabilize beyond that.

Sales of animals and farm products were generally higher in 2021/22 due to high crop yields and availability of additional revenue crop land (versus land allocated to animal feed production).

7.3.2 Research Centre Capacity and Utilization

ARIO Property Capacity and Use is measured through the calculation of a utilization rate for each Research Centre, with the 2018/19 utilization rates used as targets. For the Livestock Research Centres, the unit of tracking is an Animal Research Day (ARD). Animal use is strictly controlled by Animal Use Protocols (AUPs) required under the Animals for Research Act and Canadian Council on Animal Care (CCAC). Research Centre Managers report on actual number of days each animal is used under each trial. It is possible for animals to be used on concurrent trials if the parameters of the trial do not interfere with each other. For Crops Research Centres, the unit of tracking is land area used for plots (hectares (ha)). Area is allocated on a seasonal basis, and there is generally no overlap of trials.

The utilization rate is calculated by adding research utilization to the research preparation requirements and dividing the total by the capacity of the Research Centre. The research preparation requirement accounts for the need for crop rotation, replacement animals or cycle time in space-based animal facilities.

In general, the utilization rates for the Crops Research Centres are higher than those of the Livestock Research Centres. Crop trials, to some extent, can better expand to utilize available research plot area by increasing replications or increasing the number of varieties being tested or evaluated for breeding or performance determination. Livestock trials, on the other hand, are more limited to the nature of the resident herd or available housing spaces or types, and therefore cannot be easily scaled to increase usage. For example, in the beef cow-calf facilities at the Ontario Beef Research Centre- Elora, calving occurs once per year in early spring. Trials looking at a short period of a calf's development can only occur for the short duration post calving. It is not possible to bring in additional calves into the closed herd throughout the year, even though space may be available to conduct this type of work.

The Research Centre capacity and utilization rates for 2021/22 are shown in Tables 7.4 and 7.6. Tables 7.5 and 7.7 illustrate the average Livestock Research Centre utilization rates and the average Crops Research Centre utilization rates over the term of the Agreement.

Utilization rates, especially in the Livestock Research Centres continue to be impacted by the COVID-19 pandemic. While restrictions continued to ease throughout the year, a return to pre-pandemic research levels is expected to take some time as faculty reorganize their research and in some cases rebuild their project teams.

The Livestock Research Centres had an average utilization rate of 44.7% in 2021/22, which is approximately equal to 2020/21 rate and 9% below the target of 48.9%. There were a number of factors that influenced Livestock Research Centre utilization rates in 2021/22:

- Arkell Equine Research Facility: A number of new Tier II research trials commenced in 2021/22 with more anticipated in 2022/23 leading to full utilization of the current resident horse herd.
- Arkell Swine Research Facility: The number of ARD at the Swine Research Facility declined by approximately 25%, primarily because most projects focused on a short duration of sow farrowing and post-farrowing health. The University expects that trials at the Centre will decrease once again in 2022/23, as researchers prepare to transition to the new facility slated to open early in 2023/24.
- Ontario Aquaculture Research Station: The retirement of two active research faculty has led to a temporary reduction in trials. In addition, the quarantine and isolation facility at the Centre was shut down throughout the year due to construction. This is also expected to impact utilization in 2022/23. The recent hiring of a new faculty member focused on aquaculture and building interest from multiple academic units and outside organizations, however, are both expected to increase activity in the coming years.
- Ontario Beef Research Centre – Elora: Utilization at OBRC – Elora increased considerably in 2021/22 as the transition to new facilities neared completion and research activities resumed.
- Ontario Beef Research Centre – New Liskeard: Utilization at OBRC – New Liskeard continued to be impacted by the transition from a breeding centre to a seasonal grazing centre. Preparation for new trials focusing on pasture management was underway in 2021/22 with trials expected to commence in 2022/23.
- Ontario Dairy Research Centre: The number of ARD at ODRC decreased by approximately 8% primarily due to a backlog of projects that were short in duration and focused on a limited timeframe in the breeding cycle.
- Ontario Poultry Research Centre: The number of ARD at OPRC decreased by approximately 17% from last year. This was mainly due to the conclusion of some larger trials which were replaced by several trials that utilized smaller numbers of birds. Several new research projects commenced at the end of the year, which is expected to lead to increased utilization in 2022/23.

Table 7.4: 2021/22 Ontario Livestock Research Centre Capacity and Utilization

Ontario Livestock Research Centres	Capacity (ARD)	Research Utilization (ARD)	Research Preparation (ARD)	Utilization Rate (%)
Arkell Equine Research Facility	11,680	11,315	365	100.0%
Arkell Swine Research Facility	156,950	49,212	14,600	40.7%
Ontario Aquaculture Research Centre	111,690	3,830	28,105	28.6%
Ontario Beef Research Centre – Elora	206,995	77,680	38,895	56.3%
Ontario Beef Research Centre – New Liskeard	164,250	0	27,375	16.7%
Ontario Dairy Research Centre	173,010	28,136	83,950	64.8%
Ontario Poultry Research Centre	3,923,750	1,350,334	335,800	43.0%
Ontario Sheep Research Centre	102,200	3,023	10,950	13.7%
Ponsonby General Animal Facility	100,375	17,095	21,900	38.8%
Total	**4,950,900**	**1,540,625**	**561,940**	**44.7%[30]**

[30] Average of the Utilization Rates for each Research Centre.

Table 7.5: Average Ontario Livestock Research Centre Utilization Rates over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Average Livestock Research Centre Utilization Rate	48.9%	50.5%	44.3%	**44.7%**		48.9%

The University will continue to work with researchers and other stakeholders to find opportunities to increase utilization, where capacity exists. User coordination meetings have commenced in 2021/22 focusing on dairy and beef (pasture) related projects and it is expected that similar meetings for sheep, poultry and swine will also be held in 2022/23.

The Crops Research Centres had an average utilization rate of 81.4% in 2021/22, exceeding the target of 78.1%, and 4% more than the 2020/21 rate of 78.1%. The Crops Research Centres saw some increases in activity due to the easing of pandemic restrictions, albeit less than the Livestock Research Centres. As noted above, utilization at the Crops Research Centres tends to be more stable as field-based trials are more easily scalable to fill available areas. User coordination meetings, in the case of crops centres, will focus on how to accommodate all users when demand exceeds available space; building efficiency; and sustaining capacity with updated equipment and support infrastructure such as drainage, processing and storage capacity and staff support facilities.

Table 7.6: 2021/22 Ontario Crops Research Centre Capacity and Utilization

Ontario Crops Research Centres	Capacity (Plot Area - ha)	Research Utilization (Plot Area – ha)	Research Preparation (Plot Area - ha)	Utilization Rate (%)
Ontario Crops Research Centre - Bradford	2.06	1.62	0.00	78.4%
Ontario Crops Research Centre - Cedar Springs	7.28	6.47	0.00	88.9%
Ontario Crops Research Centre - Elora	154.35	56.25	95.51	98.3%
Ontario Crops Research Centre - Emo	17.85	7.32	2.10	52.8%
Ontario Crops Research Centre - Huron	42.90	20.23	20.23	94.3%
Ontario Crops Research Centre - New Liskeard	51.31	14.45	11.37	50.3%
Ontario Crops Research Centre - Ridgetown	96.32	39.66	52.61	95.8%
Ontario Crops Research Centre - Simcoe	46.78	15.38	26.30	89.1%
Ontario Crops Research Centre - Winchester	40.51	23.76	12.71	90.0%
Ontario Crops Research Centre - Woodstock	58.88	17.40	27.11	75.6%
Total	**518.24**	**202.55**	**247.95**	**81.4%**[31]

Table 7.7: Average Ontario Crops Research Centre Utilization Rates over the Term of the Agreement

Metric	2018/19	2019/20	2020/21	2021/22	2022/23	Target
Average Crops Research Centre Utilization Rate	78.1%	80.7%	78.1%	**81.4%**		78.1%

[31] Average of the Utilization Rates for each Research Centre.

7.4 Reporting Requirements

7.4.1 University Tenants at ARIO Research Centres

University Tenants at ARIO Research Centres are limited to private residents in houses located at the research stations. As of April 30, 2022, tenants include:

- Ontario Aquaculture Research Centre (Station Residence): Wesley Chase
- Arkell Research Station (Cottage Residence, Page Residence): Jake Henry
- Arkell Research Station (Duplex Upper, Taylor Residence): Duncan Wey
- Arkell Research Station (Duplex Lower, Taylor Residence): Tom VanDusen
- Ontario Crops Research Centre – Cedar Springs (Station Residence): Greg Watt
- Elora Research Station (Staff Residence, Hall Residence): Bev Livingston
- Ontario Beef Research Centre – Elora (Station Residence, North Witzel): Mark Randall
- Ontario Crops Research Centre – Elora (Station Residence, South Witzel): Chuck Endaman
- Ontario Dairy Research Centre (Station Residence, Campbell Soup Residence): Paul Cleghorn
- Ontario Beef Research Centre – New Liskeard (Duplex North): Vacant (Samantha Schmidt July 2022)
- Ontario Beef Research Centre – New Liskeard (Duplex South): Melinda Drummond
- Ontario Sheep Research Centre (Staff Residence): Monique Leveque
- Ontario Crops Research Centre – Ridgetown (Duplex North): Kris McNaughton
- Ontario Crops Research Centre – Ridgetown: (Duplex South): Tracy Burnett
- Ontario Crops Research Centre – Ridgetown (Wilson Farmhouse Upper): Connie Reynolds
- Ontario Crops Research Centre – Ridgetown (Wilson Farmhouse Lower – Two Units): Both Vacant
- Ontario Crops Research Centre – Simcoe (Station Residence): To be Decommissioned (Vacant)

7.4.2 Repair Priority List

The University develops and submits, typically annually, an updated Repair Priority List for each ARIO Location for the subsequent fiscal year, plus an outlook for the four years beyond that. The last list was submitted to OMAFRA in December 2021. The next list will be submitted in December 2022.

8 CONCLUSION

Collaboration and innovation are necessary for Ontario's agri-food sector to successfully rise to the challenges posed by climate change and meet the opportunity to be a national and international leader in the green economy. The 2021/22 Consolidated Annual Report articulates the activities supported by the Agreement, which advance the world-class collaboration between OMAFRA and the University of Guelph. This report demonstrates the past year's growth and investment in the body of knowledge, data, and innovation necessary to: achieve assurance in food safety; protect animal, plant and public health and the environment; grow Ontario's capacity to produce food; and support a globally and domestically competitive agri-food sector. Renewal of this Agreement will ensure the Ontario Agri-Food Innovation Alliance is leading the province's agri-food sector toward sustainability and success. The Ontario Agri-Food Innovation Alliance has demonstrated it can deliver value to Ontario and Ontarians, and this value is needed more than ever as society works to meet the defining challenge of the time: sustainability.

The Guelph Statement[32] identifies Canada as a world leader in sustainable agriculture and agri-food production that has a solid foundation of regional strengths and diversity, as well as the strong leadership of the provinces and territories. This statement includes a vision for the sector that will position Canada's agri-food producers, processors, and others for continued success as world leaders in sustainable agriculture and will enable a globally competitive sector. This vision is described as an ambitious path for the next agricultural policy framework and states five priority areas including: 1) climate change and the environment; 2) science, research, and innovation; 3) market development and trade; 4) building sector capacity and growth; and 5) resiliency and public trust.

The Impact Case Studies for the Ontario Agri-Food Innovation Alliance's Research Program demonstrate unequivocally that this world-class collaboration among OMAFRA, the University of Guelph, and ARIO translates inputs or investments into impacts that are crucial to Ontario's agri-food sector and are consistent with the five objectives of The Guelph Statement. The entire dairy value chain, field and horticultural crop breeding, livestock herd health, and bioproducts development have all benefited from the sustained investments by OMAFRA and ARIO in the University of Guelph, which are key to materializing innovations into the sector. The Impact Case Studies for the Animal Health Laboratory and the Agriculture and Food Laboratory demonstrate the value of the critical mass of expertise enabled by base funding that ensures protection of Ontario's food supply from current and anticipated threats. The Impact Case Study for the Veterinary Capacity Program demonstrates the value of the Alliance in supporting Ontario's livestock production and processing sectors.

The totality of the Agreement's impacts arising from its annual activities will continue to fuel Ontario's agri-food sector only with appropriate support. Funding for the Agreement between OMAFRA and the University has been stagnant for the better part of fifteen years, which is certainly not the case for the costs of its delivery. Beyond simply meeting the budgetary requirements of current activities, there are modernization goals planned for years six through ten of this Agreement, which will deliver the programs efficiently and effectively and drive new initiatives in sustainability, digitization, and knowledge mobilization. Through

[32] The Government of Canada, "The Guelph Statement." November 17, 2021. https://agriculture.canada.ca/en/about-our-department/key-departmental-initiatives/meetings-federal-provincial-and-territorial-ministers-agriculture/guelph-statement.

innovation and continuous improvement, the Alliance will continue to deliver its world-class impacts on Ontario's economy. In collaboration with sector stakeholders, researchers world-wide, and leveraged funding from many sources, the Agreement outcomes will be attained, ensuring that the partnership strengthens Ontario's agriculture, food, bioproduct and rural sectors for the benefit of Ontario.

APPENDIX A AUDITED FINANCIAL STATEMENTS

University of Guelph

OMAFRA Agreement

Financial information

Year ended April 30, 2022

Building a better working world

Independent auditor's report

To the management of the
University of Guelph

Qualified opinion

We have audited the accompanying Statement of Revenue and Expenses [the "Statement"] for the year ended April 30, 2022 and notes to the Statement, including a summary of significant accounting policies.

In our opinion, except for the possible effects of the matter described in the Basis for qualified opinion section of our report, the accompanying Statement is prepared, in all material respects, in accordance with the basis of accounting described in note 2.

Basis for qualified opinion

Our verification of the actual total revenues and expenses is limited to the amounts recorded in the records of the **University of Guelph**, the completeness of which is not susceptible to satisfactory audit verification. We are, therefore, not able to determine whether any adjustments might be necessary that may result in an increase to total revenues and expenses for the year ended April 30, 2022.

We conducted our audit in accordance with Canadian generally accepted auditing standards. Our responsibilities under those standards are further described in the *Auditor's responsibilities for the audit of the Statement* section of our report. We are independent of the **University of Guelph** in accordance with the ethical requirements that are relevant to our audit of the Statement in Canada, and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our qualified opinion.

Emphasis of matter – basis of accounting and restriction on use

We draw attention to note 2 to the Statement, which describes the basis of accounting. This statement is prepared to assist the **University of Guelph** to meet the reporting provisions of the agreement between the **University of Guelph** and the Ontario Ministry of Agriculture, Food and Rural Affairs ["OMAFRA"] effective April 1, 2018 [the "Agreement"]. As a result, this report may not be suitable for another purpose. Our report is intended solely for OMAFRA and the **University of Guelph** and should not be distributed to or used by parties other than OMAFRA and the **University of Guelph**. Our opinion is not modified in respect of this matter.

Other information included in the Annual Report

Other information consists of the information included in OMAFRA/UofG Agreement Consolidated Annual Report Year 4, 2021/22. Management is responsible for the other information. Our opinion on the Statement of Revenue and Expenses does not cover the other information and will not express any form of assurance conclusion thereon.

In connection with our audit of the Statement of Revenue and Expenses, our responsibility is to read the other information identified above when it becomes available and, in doing so, consider whether the other information is materially inconsistent with the Statement of Revenue and Expenses or our knowledge obtained in the audit of the Statement, or otherwise appears to be materially misstated.

The OMAFRA/UofG Agreement Consolidated Annual Report Year 4, 2021/22 is expected to be made available to us after the date of auditor's report. If, based on the work we will perform on this other information, we conclude that there is a material misstatement of this other information, we are required to report that fact to those charged with governance.

A member firm of Ernst & Young Global Limited

Responsibilities of management for the Statement

Management is responsible for the preparation of the Statement in accordance with the basis of accounting described in note 2; this includes determining that the basis of accounting is an acceptable basis for the preparation of the Statement in the circumstances, and for such internal control as management determines is necessary to enable the preparation of the Statement that is free from material misstatement, whether due to fraud or error.

Auditor's responsibilities for the audit of the Statement

Our objectives are to obtain reasonable assurance about whether the Statement as a whole is free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Canadian generally accepted auditing standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of this Statement.

As part of an audit in accordance with Canadian generally accepted auditing standards, we exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the Statement, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the **University of Guelph**'s internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.

We communicate with management regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

Ernst & Young LLP

Waterloo, Canada
June 29, 2022

Chartered Professional Accountants
Licensed Public Accountants

University of Guelph
Ontario Ministry of Agriculture, Food and Rural Affairs Agreement

Statement of revenue and expenses

[in thousands of dollars]

For the year ended April 30

UNIVERSITY OF GUELPH
ONTARIO MINISTRY OF AGRICULTURE, FOOD AND RURAL AFFAIRS AGREEMENT
STATEMENT OF REVENUES AND EXPENSES
For the period ending April 30, 2022
(in thousands of dollars)

	Research $	Veterinary Capacity Program $	Animal Health Laboratory $	Agriculture and Food Laboratory $	Property Management $	Exigency Fund (recognized) $	Total OMAFRA 2022	Total OMAFRA 2021
Revenue								
Provincial	37,385	5,352	7,905	5,923	13,837	—	70,403	67,016
Sales of Goods and Services	29	—	8,482	8,915	4,905	—	22,331	21,290
Investment Income	—	—	—	—	—	—	—	—
Other	71	—	43	53	672	—	839	1,066
Total Revenue	**37,485**	**5,352**	**16,430**	**14,891**	**19,414**	—	**93,572**	**89,372**
Expenses								
Salaries	10,693	175	8,271	8,116	8,201	—	35,457	34,118
Non Salary Benefits	2,002	29	2,269	2,341	2,173	—	8,813	8,770
Support for Faculty Costs	11,145	1,900	—	—	—	—	13,045	13,045
Travel	126	195	6	8	11	—	346	291
Operating	14,405	3,054	7,845	5,199	10,506	—	41,009	37,725
Internal Recoveries	-886	—	-1,961	-773	-1,478	—	-5,097	-4,577
Total Contract Expenses	**37,485**	**5,352**	**16,430**	**14,891**	**19,414**	—	**93,572**	**89,372**
Net Income (Expense)	—	—	—	—	—	—	—	—

See accompanying notes

University of Guelph
Ontario Ministry of Agriculture, Food and Rural Affairs Agreement

Notes to financial statements

[in thousands of dollars]

April 30, 2022

1. Authority and purpose

The University of Guelph operates as a not-for-profit entity under the authority of the *University of Guelph Act (1964)*. The University is a comprehensive, research-intensive university offering a range of undergraduate and graduate programs. With the exception of academic governance, which is vested in the University's Senate, the University is governed by the Board of Governors. The University is a registered charity [#10816 1829 RR0001] and is therefore exempt from income taxes under section 149 of the *Income Tax Act*.

In April 2018, a five-year agreement [the "Agreement"] was signed between the University and OMAFRA [Ontario Ministry of Agriculture, Food and Rural Affairs], replacing the agreement signed between the University and OMAFRA in 2008. This financial statement has been prepared under the terms of the Agreement, which requires an audited financial statement of revenues and expenses summarized by program.

2. Summary of significant accounting policies and reporting practices

[a] Fund accounting

The accounts of the University are maintained in accordance with the principles of fund accounting in order to observe the limitations and restrictions placed on the use of available resources. Under fund accounting, resources for various purposes are classified for accounting and reporting purposes into separate funds in accordance with specified activities or objectives.

[b] Recognition of revenue

The University accounts for revenue in accordance with the deferral method whereby externally restricted contributions are recognized as revenue in the year in which the related expenses are incurred. Unspent revenue is deferred until the goods or services are provided.

Unrestricted revenue is recognized as revenue when received or receivable if the amount to be received can be reasonably estimated and collection is reasonably assured.

3. Unspent revenue

The Agreement provides revenue restricted for use in approved research and service programs. Funds that were received but unspent during the year will be recognized as revenue in future years as eligible expenses are incurred.

	2022 $	2021 $
Opening balance	**51,617**	35,461
Funds received – Current fiscal year	**49,696**	66,147
Funds received – Next fiscal year	**—**	16,525
Expenditure	**(69,903)**	(66,516)
Ending balance	**31,410**	51,617

Notes to financial statements

[in thousands of dollars]

April 30, 2022

4. Minor capital repairs

The University operates facilities designated under the Agreement located across Ontario. These facilities are either owned by the Province or Agricultural Research Institute of Ontario ["ARIO"].

For ARIO owned properties, the cost of minor capital projects for facilities are funded through separate funds held by ARIO. Provincial and other revenues recognized during the year totaled $2,931 [2021 – $2,744] and $22 [2021 – $9] respectively, and operating expenses totaling $2,953 [2021 – $2,753] were incurred during the year.

APPENDIX B AGRI-FOOD AND RURAL LINK AND RESEARCH INNOVATION OFFICE CASE STUDIES

B.1 KTT Mobilization Initiatives: A Tool to Enhance Research Impact

B.1.1 At a Glance

Focus

The Ontario Agri-Food Innovation Alliance has supported knowledge translation and transfer in the agri-food sector and rural communities since 2010 with the goal of enhancing the impact of publicly-funded research.

The KTT Mobilization Initiatives (KTT-I) program, launched in 2018, is the newest tool to help enable researchers to communicate and amplify their research findings to target audiences, all with the goal of enhancing the positive impact of research. It provides one-time financial support of up to $5,000 for a product or service that translates and transfers research that benefits Ontario's agri-food sector or rural communities. This program aims to be agile and responsive to the KTT needs of UofG agri-food and rural researchers.

This case study will highlight the program's progress and feature an impactful example of how KTT-I funding opportunities are being used to create innovative products that transfer research into practice.

Goal

Researchers play a crucial role in the KTT ecosystem, delivering research findings and designing research projects with audience engagement and the 'next user' in mind. The Alliance KTT program provides resources to help researchers design and deliver KTT plans. These resources are informed by the outcomes of the KTT Funding Program, which supports research into the science of KTT (research stream), and provides operating funds to mobilize research using events, communications products, field days and other audience-specific tactics (mobilization stream). Prior to the development of the KTT-I grant, there were no nimble, responsive programs to support researchers who had a unique opportunity to deliver a single, timely KTT product to enhance research impact.

Strategy

The KTT-I funding program is the newest addition to the Ontario Agri-Food Innovation Alliance KTT Funding Program portfolio and takes a novel approach by providing small-dollar financial support to deliver a KTT product. Researchers can apply at any point throughout the year and the streamlined review process allows for applications to be reviewed and approved or declined faster than through the panel review process. Projects may take up to twelve months to complete.

KTT-I proposals must fall within an established OMAFRA research priority. KTT-I projects do not need to address a specific research question but must relate to one of the eleven identified priorities and must demonstrate a high likelihood of contribution to the health, sustainability, and/or competitiveness of Ontario's agri-food sectors and/or rural communities.

Benefits to the Agri-Food Sector

The flexibility of the KTT-I program allows researchers to secure funds for a specific KTT product designed to engage target audience(s) with research findings. Researchers can use the KTT-I funding to go above and beyond their existing KTT commitments detailed in projects or engage a new opportunity to translate and transfer research. By offering a diverse portfolio of funding options, the Alliance helps researchers take advantage of the funding program that fits with where they are in their research journey.

B.1.2 Increasing the Buzz About Honey Bee Research

The following example of a project funded through the KTT-I program demonstrates how small, strategic financial support can make a big difference in translating and transferring research findings to producers.

Project title: Honey Bee Research Centre – Educational Videos and Online Outreach

Lead applicant: Dr. Ernesto Guzman, Professor and Director of the Honey Bee Research Centre/Pinchin Family Chair in Honey Bee Health.

Lending a Helping Hand to Honey Bees

Honey bees are one of the most important pollinators of agricultural crops, and part of the mandate of the UofG Honey Bee Research Centre (HBRC) is to "help honey bees continue this vital work."

Research at the HBRC focuses on all things honey bee, including health, hive productivity and bee breeding. This research builds on a long tradition of the HBRC to support the insects that play such a critical role in our food systems: in 1894, the first beekeeping courses were taught at the Ontario Agricultural College. In 1920, an apiculture building was built on campus at the present site of the University Centre and was the first of its kind in North America for beekeeping studies. In 1966, the apiculture facilities were moved to the current location on Stone Road in Guelph, Ontario. These facilities are unique not only in Ontario, but also in Canada. This infrastructure is instrumental for conducting fundamental and applied research, extending new knowledge through tours, courses and videos, supporting networks of learning, encouraging and educating new beekeepers and raising public and political awareness of vital issues to the industry.

Translating and Transferring Honey Bee Research and Best Practices

Since 2016, the HBRC has produced high-quality, educational videos which are made available for free to beekeepers of all levels and the public via the University of Guelph Honey Bee Research Centre YouTube Channel. With support from the KTT-I program, the HBRC aimed to expand their online content to provide science communication and educational content for beekeepers. Specifically, the funding was used to invest in highly qualified personnel to produce the videos, provide technical support, manage the HBRC website and social media channels. The video series and other online content:

- Translated recent and relevant honey bee research to Ontario beekeepers.
- Provided evidence-based information in a format that was easy to understand.
- Shared knowledge and skills that can be directly applied to management practices in Ontario's beekeeping industry.

Research transferred through the videos included:

- Best management practices, including colony overwintering methods, making up for colony losses.
- Breeding and genetics, including breeding for Varroa mite resistance (new research from the UofG).

- Pest/disease control and monitoring, including thymol as a treatment for Varroa mites (new research from the UofG), evidence-based treatments, and responsible practices for monitoring and controlling pests and disease.

The Numbers

- **17 educational videos:** videos demonstrate and promote research-informed best practices.
- **215,000 views:** in total, the 17 videos have been viewed 215,000 times, and have been featured as part of in-person and virtual training and extension activities.
- **8 languages:** videos have been translated into eight languages and reached audiences in the United States of America, India, United Kingdom and Australia.

Behind the Numbers: Benefits to the Agri-Food Sector

Building a strong, well-informed beekeeping industry is critical to supporting the health of these pollinators. As Dr. Guzman noted in his application, when beekeepers are aware of proper management practices, they can quickly identify pests and disease, and prevent them from spreading to neighboring beekeepers. They can also apply treatments in a way that prevents transfer to the honey used for human consumption. Properly managed colonies are strong and more efficient at pollinating crops, which benefits the entire agricultural industry.

One of the most significant challenges to the health of bee populations is the recent rise in Varroa mite infestations. In a recent CBC news article, Ontario beekeepers report 'heartbreaking' colony losses due to varroa mites, the Ontario Beekeepers' Association reported that their members are sometimes experiencing up to 90 per cent mortality of their colonies due to the mite. As part of the KTT-I project, the HBRC produced three Varroa mite videos which received good engagement on YouTube. Many end users engaged with the HBRC via YouTube by posing questions and sharing their beekeeping experiences. Below are some comments from YouTube subscribers to the HBRC channel posted in response to the YouTube Video: Low Varroa Growth Part 1:

> "Wow, I am glad you are back. I have watched most of your previous videos over and over again. For beekeepers you are a valuable source of great information."
>
> "Well this was unexpected!!! Welcome back Paul!!!!! Can't wait for the rest. Are you doing all the breeding traits within the Buckfast program or bringing in new genetics/traits?"
>
> "Glad this source is active with a video. As a new beekeeper I'm [sic] watched their videos and would love to see more. This is a good source - unlike some others. Thanks!"
>
> "Great to see you back Paul! I started beekeeping after watching your videos two years ago. I am in the midst of doing varroa counts on my three hives and thought I would double check your original videos and this new video popped up! What fantastic timing. I can't wait to see the rest of the videos and the results of Guelph's research!"

B.1.3 Extending the Reach of Research

The Honey Bee Research Centre KTT-I project is one of ten projects that have been funded since the program launched in 2018. With a modest investment in funds, the program has increased distribution of research that benefits the agri-food sector. Table B.1 summarizes project deliverables and corresponding reach for four more KTT-I projects to demonstrate how a small investment of funds can greatly expand the reach of research findings.

Table B.1: Impact Metrics from select KTT Mobilization Initiatives Projects

Year	Project	Lead Applicant	Product / Activity	Audience	Results[33]
2019/20	Improving knowledge in identifying high-risk male calves	David Renaud	White board animation posted on YouTube channel	Dairy producers	1,742 video views
2019/20	Understanding protein foods: Creation of resources to support the agri-food sector	David Ma	Plant-based Recipes Made Easy-Peasy Cookbook	Families across Canada	English version: 6,897 pageviews, 4086 downloads; French version: 572 pageviews, 511 downloads
2019/20	'The Cereal Box': Optimization and Multiplication	Iris Joye	Cereal outreach sessions	High school students and teachers	9 outreach sessions; 282 total participants (average of 31 per session)
2019/20	Smart Calf Rearing Conference - Producer Day	Michael Steele	Producer Day conference event, knowledge transfer videos, digital illustrations Newsletter	Dairy producers and industry representatives	Over 300 individuals attended the event; 90% of attendees who completed the survey rated the event “very good” or “excellent”; 200 copies of newsletter handed out

[33] Metrics are accurate as of April 30, 2022.

B.2 Undergraduate Student Experiential Learning Program: Experiential Learning Opens New Doors for UofG Undergrads

B.2.1 At a Glance

Focus

The Undergraduate Student Experiential Learning (USEL) Program supports agri-food knowledge mobilization and helps develop the next generation of agri-food innovators. USEL gives senior UofG undergraduate students the opportunity to gain work experience and hone their knowledge translation and transfer skills through a summer work placement. USEL exposes UofG students to opportunities outside the lecture halls, providing hands-on learning and new skills that support a professional career in the agri-food sector.

This case study will provide an overview of the USEL program and showcase the impact the program has had on two undergraduate students.

Goal

Started in 2010, USEL was initially designed as a KTT project that engaged undergraduate students to conduct industry-relevant research and communicate the findings to government and producers. Today, the program is an established feature of the OMAFRA-UofG Agreement.

Strategy

The USEL program is the only Alliance program specifically targeted at undergraduate students. While undergraduates often participate in research and KTT projects funded through the Alliance, the USEL program provides focused experiential learning opportunities for students that support one of the Agreement's main objectives – to train the next generation of agri-food leaders and innovators.

USEL creates summer job opportunities for a handful of students each year to work on industry issues in collaboration with OMAFRA specialists and UofG faculty members, who provide mentoring, coaching, and advising. Projects are identified by OMAFRA specialists and focus on research and KTT topics that address a need in the agri-food sector. USEL students are selected through a competitive hiring process and work on their projects during the Summer semester (May to August) and produce a final report when the project is complete.

Benefits to the Agri-Food Sector

The USEL program provides students with the opportunity to gain work experience in the agri-food sector while delivering research findings that help producers. By fostering KTT knowledge and skills, students are better prepared to continue their education or enter the workforce. These benefits speak to one of the main objectives of the Alliance: to provide resources and training to help establish the future of the agri-food sector.

B.2.2 Advancing Knowledge and Building Capacity

The following is an overview of two USEL student projects completed in 2021.

Body Condition Score Influence on Colostrum Production and Quality in Small Ruminants - Hanna Michaels

Hanna Michaels, a fourth-year student in the Ontario Agricultural College majoring in animal biosciences, completed a project on colostrum production and quality in small ruminants during the Summer of 2021. The main objective of her study was to investigate the relationship between colostrum quality and body condition score (BCS) in sheep in the hopes of contributing new research to address a significant challenge to producers – high lamb mortality.

Colostrum is the "first milk" produced by mammals, and is dense in nutrients, antioxidants, and factors that support growth and a healthy immune system for the offspring. High quality colostrum is important to grow healthy, productive animals and is critical in staving off early lamb mortality by establishing a healthy immune system. By learning more about the quality of colostrum in dams (pregnant ewes) and determining if there is a relationship between BCS and colostrum quality, producers may be able to adjust management practices to improve the health of the dam and increase the likelihood of lamb survival.

To assess the relationship between body condition and colostrum quality, Hanna and her mentors completed a BCS for dams (mothers) and then measured the quality of the animal's colostrum. One of the approaches to assessing the quality of colostrum is based on the levels of a specific immune system antibody called Immunoglobulin G or IgG. Higher levels of IgG help establish the offspring's immune system. In the case of sheep, high quality colostrum from the dam, which includes higher levels of IgG, likely means better health outcomes for the lamb and a sustainable herd for the farmer.

Colostrum samples were taken at a sheep producer in central Ontario at two different lambing times, and the dams were simultaneously assessed for their BCS. Hanna's study found that while there is a wide variation in colostrum IgG concentrations between dams sampled at different lambing points in the year (Winter and Spring), dams with a higher BCS had lower IgG concentrations than ewes with a lower BCS. With more research, this may give producers a new tool to predict the colostrum quality of dams and take steps to improve it, if necessary.

In addition to the project's findings that will help producers make informed decisions about production practices to improve colostrum quality, Hanna also developed skills for translating and transferring research findings to producers. Hanna learned that these KTT skills are an integral part of the research process and her experience in the USEL program has better equipped her to apply these principles in her future studies and career.

"I think effectively communicating science-based information is perhaps as important as the research itself to ensure the Canadian agricultural industry continues to be on the cutting edge."

Hanna Michaels, USEL participant

Characterization of Winter and Spring Wheat Breeding Lines to Fusarium Head Blight (FHB) Disease - Riley McConachie

Riley was a third-year student in UofG's School of Environmental Sciences when he worked on a project looking at resistance to fusarium head blight (FHB) in different cultivars of wheat. FHB is responsible for approximately 21 percent of losses in wheat yield globally. Since wheat is the third most produced crop in the world, and global demand for foods produced from wheat is increasing, FHB poses a serious threat to the

agricultural industry. While most of the wheat in Canada is grown in Saskatchewan, Alberta and Manitoba, Ontario produces on average 500,000 to 1 million acres of wheat per year, depending on weather conditions. FHB thrives in wet, humid conditions, and, in addition to yield loss, can produce a toxin (deoxynivalenol, or DON) that is harmful to humans and livestock. The key to prevention is finding cultivars that are resistant to FHB and using a fungicide when 15 percent of the crop is in the flowering stage.

Riley's project involved planting different cultivars of winter and spring wheat and artificially inoculating them with FHB. Disease severity and incidence was then recorded for each plot 20 days after inoculation. After harvesting the wheat, the crop was tested for resistance to FHB. Although test results are still pending, Riley was able to participate in some KTT activities and communicate about the project with producers and advisors. Riley assisted with an article for Field Crop News, which contains post-harvest information on managing fields infected with FHB. In addition, he also presented his work at the University of Guelph Field Day.

When interviewed in a recent Alliance news article, Riley stated that knew he wanted to continue his studies with graduate work before applying to USEL, and the experience only strengthened his resolve to pursue a master's degree.

"I absolutely love working in the field, and definitely want a career in agricultural research. And I know this experience will help me get a job in this field."

Riley McConachie, USEL participant

B.2.3 The Numbers

USEL positions are posted on the UofG Experiential Catalogue website. Since the inception of the program in 2010, the program has received steadily increasing interest and there have been on average 35 applications per year,. More than 70 students have participated in the program since its inception in 2010.

Table B.2: Summary of Applications and Positions Awarded by Year

Funding Year	Branches of OMAFRA Involved in the Program	Number of Applications	Number of Positions Awarded
2010	Agriculture Development Branch	14	5
2011	Agriculture Development Branch	14	5
2012	Agriculture Development Branch	21	5
2013	Agriculture Development Branch	23	5
2014	Agriculture Development Branch	21	5
2015	Agriculture Development Branch	44	5
2016	Agriculture Development Branch	23	5
2017	Agriculture Development Branch	35	5
2018	Agriculture Development Branch	51	5
2019	Agriculture Development Branch	55	8
2020	Agriculture Development, Environmental Management, and Food Safety Systems Development Branch	51	8
2021	Agriculture Development, Environmental Management, and Food Safety Systems Development Branch	66	10
Total		**418**	**71**

B.2.4 Behind the Numbers: Agri-Food Sector Benefits

After more than a decade, the USEL program continues to attract applications from as many as 60 undergraduate students a year who are eager for research and work experience in the agri-food sector. Carmela Cupelli, business development specialist with OMAFRA who's been administering the program since its inception said in a recent Alliance news article. "The premise is that students gain experience working on an existing research project in the agriculture industry and learn to develop and present materials that communicate results to farmers."

Based on a survey of graduates, the USEL program has made a noted impact on their career path and employability. Of the graduates from 2012 to 2020, 96 per cent hold positions in the public, private and/or non-profit agri-food sectors that deliver research, teaching, agri-food processing, value-chain management, and veterinary medicine.

"We are clearly filling a gap that adds hands-on skills to book skills and benefits the entire agri-food sector."

Carmella Cupelli, Business Development Specialist and OMAFRA USEL Coordinator

Dr. Helen Booker, associate professor in the Department of Plant Agriculture at UofG and USEL mentor, also sees the program's significant benefit to the students and the agri-food sector.

"It is a pleasure to have dynamic and talented students join us in the field. Training the next generation of agri-food leaders who are able to take innovation and research to the next level will provide us with a robust agri-food sector for generations to come."

Dr. Helen Booker, USEL mentor, associate professor, Department of Plant Agriculture, UofG

B.3 Breeding Innovation: How the UofG's Research Innovation Office Helps Bring New Crop Varieties to Ontario Markets

B.3.1 At a Glance

Focus

The Ontario Agri-Food Innovation Alliance supports a research and innovation ecosystem that breeds novel, beneficial germplasm for Ontario producers.

Within this ecosystem, Alliance-funded researchers and technicians work with industry collaborators and producers to develop and trial new crop varieties for Ontario growers. Behind the scenes, intellectual property support provided by the Research Innovation Office (RIO) at the UofG helps turn tested varieties into marketable products tailored to Ontario growing conditions.

This case study looks at the critical role RIO plays, particularly the Technology Transfer Manager – Germplasm, in bringing new crop varieties to market, from supporting industry collaborations to enabling intellectual property protection, and profiles the UofG dry edible bean breeding program.

Goal

Among its objectives, the Ontario Agri-Food Innovation Alliance seeks to build a world-class research and innovation system that delivers positive impacts for Ontario and Ontarians. To meaningfully meet this objective, the Alliance works to provide the agri-food sector with the tools it needs to thrive, including new, higher-yielding, disease-resistant crops tailored to Ontario growing conditions.

Delivering new crop varieties takes time. Breeding new varieties, selecting for beneficial traits, and conducting variety trials can take up to 25 years, depending on the species, and requires collaboration across industry, academia, and producer organizations.

Strategy

With support from OMAFRA, the UofG works with partners to deliver public breeding programs. Public breeding programs are complementary to private sector breeding programs and fill an important need by providing regionally adapted cultivars that address the specific requirements of growers and their customers. Public breeding programs help train the next generation of plant breeders. They are set up to take on longer-term projects with greater risk and can deliver a focused approach on regionally adapted cultivars (small markets) with direct benefits to sustainability and competitiveness for local (provincial) growers.

But the hard work of breeding, selecting, and trialing new varieties is only one piece of the puzzle – ensuring proper intellectual property protection allows for varieties to be brought to market and incentivizes innovation.

RIO is a critical player in the commercialization pipeline for inventions, including the development of plant varieties, that emerge from research at the UofG. RIO's input and support to researchers during the licensing process is a major boost to the breeders' programs. RIO manages the intellectual property protection on varieties, including plant breeders' rights (PBR) on behalf of the UofG. RIO issues the call for proposals and evaluates each against the others to decide who will be awarded the licensing rights for a particular plant variety.

The Technology Transfer Manager – Germplasm is key in the process of securing intellectual property and works with industry partners to license and propagate new varieties. The role oversees the plant germplasm portfolio and assists researchers in licensing their plant varieties into the market. The Manager also works

with seed companies and propagators to find companies interested in plant varieties developed by UofG breeders. And, foundational to all of this is securing intellectual property for new varieties via PBR.

Benefits to the Agri-Food Sector

Plant varieties developed by the UofG and licensed with the support of RIO are grown by thousands of producers in Ontario and have found markets in the rest of North America and beyond. Globally, plant breeding has been critical in improving food security and meeting increasing demands for food.

Over the last 30 years, there has been a 50% increase in the productivity of major agricultural crops in Canada. Plant breeding has contributed significantly to these gains by delivering varieties with higher yields and improved agronomic traits, such as disease resistance and stress tolerance.[34]

Intellectual property protection for new plant varieties ensures the economic and environmental benefits of breeding research are realized by industry and made available to the sector. In addition, plant germplasm represents a substantial portion of the UofG's intellectual property portfolio, demonstrating the University's leadership in germplasm research and the return on OMAFRA's investment.

B.3.2 Advancing Knowledge and Building Capacity

The Numbers

- $1.27M is the annual total revenue for the germplasm bank in 2021/22
- 14 plant breeders' rights (PBR) applications submitted in 2021/22, including three new varieties of dry beans
- 3 new varieties of dry beans (white navy bean, cranberry bean, and pinto bean) licenced to Canadian seed companies

B.3.3 Behind the Numbers

UofG Welcomes New Technology Transfer Manager – Germplasm in 2021

Rebecka Carroll joined the University of Guelph in September 2021 as the new Technology Transfer Manager – Germplasm overseeing the germplasm portfolio.

Carroll joined from the University of Alberta where she was a Transfer Manager on the Natural Sciences and Engineering Team. She brings great expertise in plant breeding and technology transfer, especially related to wheat and canola. Carroll spent the first eight years of her career in a plant molecular biology lab at the University of Alberta before transitioning into technology transfer roles, in which she spent ten years managing a diverse portfolio of technologies in natural and life sciences, and agriculture. Carroll has a background in molecular biology and a Master of Business Administration with a focus on technology commercialization from the University of Alberta.

[34] "Plant Breeding Benefits your Farm." Canadian Seed Growers Association, Accessed July 21, 2022, https://seedgrowers.ca/farmers/plant-breeding-benefits-your-farm/

Carroll spent the winter months of 2021/22 learning more about the University of Guelph's breeding programs, negotiating license agreements for new varieties, and advancing PBR protections on several plant varieties. Spring is an incredibly busy time of year for the Technology Transfer Manager - Germplasm. The Crop Specific Registration Recommending Committees meet in February or March to review applications for registration of newly disclosed varieties. Industry partners usually attend these meetings to gain insight into the new varieties eligible for commercial production, which is optimal timing for the open call for licensing proposals from industry. A key requirement of the call for proposals is the commercialization plan, which is evaluated by Carroll to ensure that the plan is sound and reasonable. The plan would include both the amplification/certification plan and anticipated sales volume over a five-year period. RIO receives yearly reports from licensees on this process.

Varieties that are successfully licensed, either through an open call for proposals or from a pre-negotiated agreement, will then have applications for PBR filed. Carroll works with and supports the researcher during this process. The PBR application takes two to three years of field trials to complete.

B.3.4 Breeding Better Beans: A Snapshot of the Intellectual Property Process

The Alliance plays a critical role in the plant breeding ecosystem by funding research technicians, research centres, and intellectual property supports to ensure that researchers have the tools they need to bring new varieties to market. This investment by OMAFRA through the Alliance also leverages and attracts support from other partners in the agri-food ecosystem. The result is a collection of robust breeding programs that return value to producers and consumers alike. One of the most successful of these programs is the dry bean breeding program.

Dry edible beans are a nutritious, high-value crop. Ontario-grown dry beans, including white (navy), kidney, cranberry, black, otebo, and adzuki accounted for $133 million in farm gate receipts in 2020. The publicly funded bean breeding program at the University of Guelph, made possible by the Ontario Agri-Food Innovation Alliance, has greatly contributed to the success of Ontario's bean industry. Long-term provincial investment in research funding, technicians, and infrastructure has attracted substantial investment from industry partners and the Federal Government. The breeding of new bean varieties has improved disease resistance, yield, and product quality.

Research in dry beans at the UofG is led by Dr. Peter Pauls. Pauls' laboratory has focused on understanding the genetic basis of agriculturally relevant traits – such as disease resistance, vitamin content, nitrogen fixation ability, seed coat colour, and yield – and developing new methods to select for these traits and develop new varieties. Pauls' laboratory has been wildly successful in developing new varieties of dry beans that are great for growers and consumers alike. Pauls has worked with a research technician (who is also supported via the Alliance) since joining the UofG. He worked with technician Tom Smith until 2019 and Lyndsay Schram currently. Technicians are critical to the success of breeding programs, helping deliver and monitor field work, planting, assessing, and harvesting crops. With support from expert technicians, Pauls has developed 21 new dry bean varieties since 2003 that have, with the help of RIO, been licensed to seed companies.

One of Pauls' most successful varieties, the red kidney bean named Dynasty, was recognized as the 2022 Seed of the Year by the Ontario Bean Growers. The Dynasty variety, released in 2014, was developed at the Ontario Crops Research Centre—Elora as a high-yielding, full-season, dark red kidney bean. The variety has been a big winner with Ontario growers and now accounts for 90 percent of the domestic red kidney bean market, with growing demand in the United States and France. Compared to other kidney bean varieties, Dynasty delivers a 15 percent yield boost and has been a boon for Ontario dry bean growers, with increased productivity and revenue for the sector.

In 2020/21, Pauls continued to build on the success of his dry bean breeding program, disclosing three new varieties to RIO. This internal disclosure process describes the development and benefits of a new variety, and information from the disclosure is used by the Technology Transfer Manager – Germplasm to engage prospective seed companies that can submit bids to licence and sell the new variety. In 2021/22, Pauls' three new varieties – a white navy bean, a cranberry bean, and a pinto bean – were licensed to seed companies, providing three new bean varieties to the provincial and national dry bean sector. Carroll also supported Pauls in submitting Plant Breeders Rights for the three licenced varieties. Carroll is currently negotiating licenses for six additional varieties disclosed in 2021/22: one dark red kidney bean, two white navy beans, two black beans, and one pinto bean. Licenses for these varieties will be finalized in 2022/23.

The success of the dry bean breeding program continues to return value to growers and the Alliance. Dry bean licence revenues continue to grow – with a 24 percent jump from 2018/19 to 2019/20 – largely on the strength of the Dynasty variety. Carroll sees an opportunity to continue to increase industry interest and uptake of new dry bean varieties. She'll be working with colleagues at RIO, OMAFRA, and Ontario Bean Growers to complete market research, including analyzing current literature on market drivers for Ontario's bean industry. Carroll hopes that the findings of her market studies will help better inform licensing and industry partnership decisions, as well as showcase UofG's new varieties of dry beans and increase industry uptake as the market continues to grow.

For his part, Pauls and his team have continued to enhance the dark red kidney bean market for Ontario with varieties that offer better disease resistance, increased yield, and enhanced product quality. Pauls said in a February 2022 Alliance news article, "We are focused on developing novel bean lines that can be commercialized and used by bean producers in Ontario, Canada and around the world. The research associates and graduate students in the bean breeding program are also uncovering the genetic bases for disease resistance, vitamin content, nitrogen fixing capacity, seed coat colour and yield."

For more information on how the Alliance supports successful breeding programs at the University of Guelph, visit the webpage for the Research Impact Case Study: Breeding & Genetics.

APPENDIX C EARLY DETECTION AND EFFECTIVE RESPONSE TO FOREIGN ANIMAL DISEASES

Three representative AHL pathology cases were submitted to OMAFRA for comment in order to monitor timeliness of testing, results, and communications. Where available, OMAFRA comments are included below in italics.

C.1 Case 1: Renal Infection with *Leptospira* Pomona Identified in OMAFRA Veterinary/Food Safety Inspection Slaughter Hogs.

AHL Case G22-013690

The case co-ordinator was Dr. Margaret Stalker, Pathologist. Dr. Davor Ojkic, Virologist, provided the new method development for the case.

16 February 2022 12:02 pm AHL Specimen Room received 14 bags of fresh tissues from 7 market hogs from Plant # 0063, Reist & Weber Butchering Custom Killing & Whole Sales Pork, Woodstock ON, via Dr. D. Kirkbright, OMAFRA Vet Services Meat Histopathology Surveillance program.

Postmortem lesions noted at slaughter by Meat Inspector Robert Kolarov were as follows as per the history provided:

- Kidneys: range from 90% affected by flat white, coalescing, fairly well-demarcated foci (0.5-1.0 cm) throughout; to 50-100, pinpoint, raised, well-demarcated, white-tan, cortical nodules with thin red rim; to flat, 1-2 cm, geographic, bright to dark red, cortical extending into the medulla foci (differential diagnoses: acute hemorrhagic infarct vs hemorrhage)
- Renal lymph nodes: large in all animals: range from tan to red to having petechiae
- No other lesions in the body: good BCS

The fresh tissues were examined, subsampled, and placed in formalin for fixation prior to histologic processing by Dr. J. DeLay, AHL. Excess fresh tissue was re-packaged and held frozen in Specimen Reception.

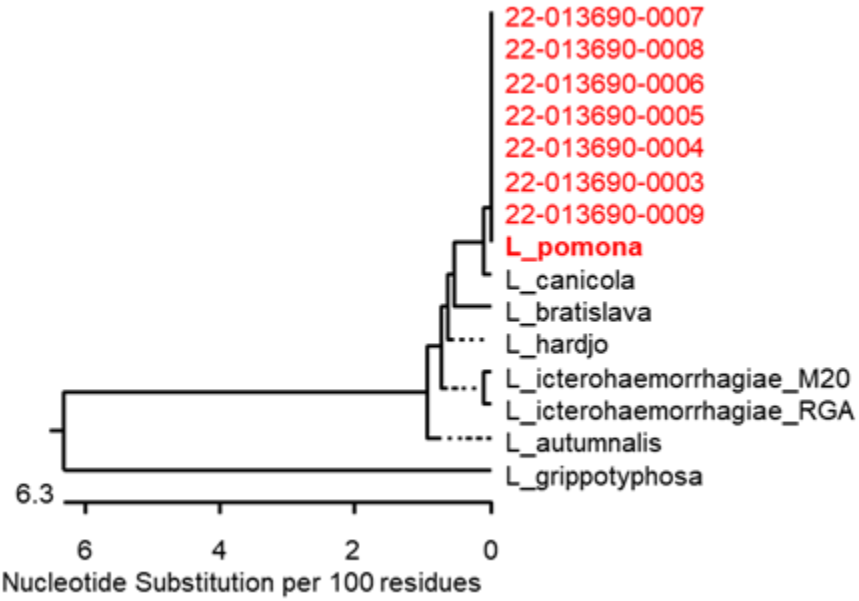
Fixed tissues were trimmed and processed overnight for histology, which was read, interpreted, and released on 18 February 2022 11:40 am by Dr. Margaret Stalker, who noted lesions suspicious for chronic leptospirosis, and suggested follow-up testing to confirm. The University of Guelph was actually closed due to a winter storm on Friday 18 February, but AHL remains operational and is staffed as an essential service for the province during such closures, and Dr. Stalker was at work reading histology and releasing reports.

Dr. Kirkbright received the histopathology report and responded by email on 18 Feb 2022 12:21, sending gross photographs of the renal lesions to Dr. Stalker. Email communications between Dr. Kirkbright and Dr. Stalker continued over the course of the day (logged below) to work out the best plan for expeditious confirmation of the diagnosis, as Monday 21 February 2022 was a statutory holiday. *Leptospira* PCR was chosen as the best confirmatory test, and kidney tissues were pulled from the freezer and delivered to AHL Virology at 4:15 pm.

PCR testing on the kidney tissues was reported as POSITIVE for *Leptospira* sp. on 23 February, on each of the kidney samples submitted, with cycle thresholds ranging from 25.87 to 33.83. As we have not seen leptospiral nephritis in our swine caseload in recent years (a database review of all porcine histology cases from 2008-present revealed no previous diagnoses, and a similar review of 230 *Leptospira* sp. PCR tests run on swine at the AHL since 2017 also revealed only a single positive test on placenta from an abortion case), both OMAFRA and AHL were interested in determining the serovar involved. However, serotyping requires serum from live

animals. At this point, Dr. Davor Ojkic, AHL Virology, took the lead, and in the next three weeks worked to develop an in-house *Leptospira* genotyping assay based on single-nucleotide polymorphism (SNP) analysis of the SecY gene. Results of this assay confirmed that the *Leptospira* in this case was genetically compatible with *Leptospira* Pomona (Figure C.1 below).

Figure C.1: Results of single-nucleotide polymorphism (SNP) analysis of the *Leptospira* SecY gene confirm case 22-013690 isolates were indistinguishable from *L.* Pomona (D. Ojkic pers comm, 16 March 2020; ref. Cerqueira et al. 2010. Bioinformatics describes novel loci of high resolution discrimination of *Leptospira* isolates. PLoS ONE 5(10): e15335).



Results reporting and turnaround times

A. Histopathology: Date authorized 18 February 2022, 11:40

B. *Leptospira* sp. PCR: Date authorized 23 February 2022, 10:34

C. Virology method development: *Leptospira* genotyping: Date authorized 16 March 2022, 14:05

Histopathology report

KIDNEY 1: Two sections examined, with multifocal to locally extensive cortical interstitial infiltrates of plasma cells and lymphocytes, with variable tubular atrophy and edema. In several of these, tubules contain sloughing degenerate epithelium, cellular debris and neutrophils, which spill into the adjacent interstitium accompanied by fibrin in some areas.

KIDNEY 2: A single section examined, again with locally intense lymphoplasmacytic interstitial infiltrates within the cortex, centered on dilated tubules filled with neutrophils and cell debris. Tubules filled with neutrophils extend into the medulla.

KIDNEY 3: A single section examined, with widespread patchy interstitial edema, tubular atrophy, tubules filled with neutrophils, lymphoplasmacytic inflammation and fibrosis extending throughout the cortex and medulla to the renal pelvis. Scattered lymphoid nodules/follicles are present as well within the cortex.

KIDNEY 4: A single section examined, with a single densely cellular lymphoid nodular aggregate in the cortical interstitium, and two smaller lymphocytic perivascular infiltrates near the corticomedullary junction.

KIDNEY 5: A single section examined, with numerous scattered cortical interstitial infiltrates of lymphocytes and plasma cells with occasional small lymphoid nodules, extending throughout the cortex and medulla. Tubules in these areas are variably atrophic, and a few contain neutrophils.

KIDNEY 6: A single section examined, with extensive changes similar to kidney 3.

KIDNEY 7: A single section examined, with histologic changes similar to kidney 2.

ILIAC LYMPH NODES (slide 8): Seven sections examined, with no significant histologic lesions observed.

BRONCHIAL LYMPH NODES (slide 9): Seven sections examined, with no significant histologic lesions observed.

RENAL LYMPH NODES (slide 10): Seven sections examined, with mild follicular and paracortical lymphoid hyperplasia in five sections.

LUNG (slide 11,12): Seven sections examined, with no significant histologic lesions observed.

LIVER (slide 13,14): Seven sections examined. One section has mildly increased thickness of the interlobular fibrous septa near the lobar periphery, with few infiltrating lymphocytes.

SPLEEN (slide 15): Seven sections examined, with no significant histologic lesions observed.

HISTOLOGIC DIAGNOSES:

1. Mild lymphoid hyperplasia, renal lymph nodes x 5
2. Lymphoplasmacytic interstitial nephritis (1,2,3,4,5,6,7) with suppurative tubulonephritis (1,2,5,7) and pyelonephritis (3,6)

COMMENT/INTERPRETATION: Histologic changes are of a chronic and active tubulointerstitial nephritis with suppurative nephritis and pyelonephritis. The presence of discrete interstitial lymphoid nodules raises the possibility of chronic *Leptospira* infection. I am going to order an immunohistochemistry stain out of interest in this case to pursue this further.

Communications – internal (AHL) and with the client (OMAFRA)

2022-Feb18 11:40: Dr. Stalker released the histology results.

2022-Feb18 12:21: Dr. Kirkbright emailed Dr. Stalker to thank her for the extensive report, provided six photographs taken of the renal lesions at the processing plant, and asking additional follow-up questions re interpretation of the lesions.

2022-Feb 18 12:23: Dr. Kirkbright emailed Dr. Stalker to ask an additional interpretive question about the histologic lesions noted.

2022-Feb 18 12:27: Dr. Stalker emailed Dr. Kirkbright to answer the interpretive questions.

2022-Feb 18 12:29: Dr. Kirkbright emailed Dr. Stalker to discuss the extent of the histologic lesions, and to ask the most expeditious method of confirming the diagnosis, given the holiday long weekend.

2022-Feb 18 12:56, 12:59: Dr. Stalker emailed to confirm that PCR would be the most rapid test method, and that the original tissues submitted with the case were already in the lab and would be the best test substrate.

2022-Feb 18 1:21: Dr. Kirkbright emailed to say she was contacting her supervisor regarding the best approved plan for diagnosis. Dr. Stalker confirmed with the AHL Virology lab that the PCRs could be run on Tuesday 22 Feb 2022.

2022-Feb-18 3:46: Dr. Kirkbright emailed to authorize *Leptospira* PCR, to be run on each of the seven pigs individually.

2022-Feb- 23 4:18: Dr. Kirkbright emailed to thank Dr. Stalker for her work on the case.

2022-Feb-25 9:00: Dr. Stalker presented case at AHL Histopathology rounds and discussed possibly genotyping/serotyping the *Leptospira* with Dr. Spinato.

2022-Feb-28 8:42: Dr. Kirkbright emailed to inquire about pursuing *Leptospira* serotyping on this case.

2022-Feb-28 5:36: Dr. Ojkic confirmed that rather than serotyping, it may be possible to genotype the *Leptospira*.

Follow-up required from diagnostic conclusion

This case is the first to confirm the presence of *Leptospira* Pomona in Ontario market hogs.

Final resolution from the AHL perspective

This case demonstrates the utility of the AHL meat inspection histopathology service, with rapid detection and confirmation of an apparently uncommon condition in Ontario swine. AHL's response also highlighted the rapid development of a new diagnostic test for genotyping *Leptospira*, a zoonotic pathogen that is widespread in its potential impact in farmed, companion and wild animal populations.

Review of the Case by OMAFRA

The following is a review of the summary report by Dr. Christa Arsenault, OMAFRA, on June 17, 2022.

> *The report by Drs. Stalker and Ojkic summarize an unusual case of lesions compatible with Leptospirosis found in a slaughter inspection of hogs in February 2022. Fourteen bags of fresh tissues from 7 different market hogs were submitted from Plant #0063 and received on February 16, 2022, at the AHL. Postmortem lesions noted at slaughter by an OMAFRA meat inspector were 90% of the kidneys had flat, white, coalescing, fairly well-demarcated foci throughout with cortical nodules. A bright dark red, cortical extending into the medulla foci was noted. Fixed tissues were trimmed and processed overnight for histology and results were released on February 18, 2022. It is important to note that the UofG was closed due to a winter storm this day, but that the AHL remained operational on this date for essential animal testing services. Dr. Stalker worked with the OMAFRA meat inspector on this case who sent her photographs of gross lesions. They worked together on what the best plan forward would be to determine confirmation of a diagnosis. Monday February 21, 2022 was a statutory holiday, but saved frozen kidney tissues samples from the original submission were tested for Leptospira PCR and confirmatory positive results were communicated on February 23, 2022.*
>
> *Searching back through AHL cases there was only one other case of Leptospirosis in swine found in an abortion case submitted in 2017. Due to the rarity of this pathogenesis in commercial swine, both OMAFRA and the AHL were interested in knowing the serovar involved. Dr. Ojkic took the lead on conducting this testing which required serum from live animals. Over the next 3 weeks Dr. Ojkic worked to develop an in-house Leptospira genotyping assay. Results from this assay determined that this case was genetically compatible with Leptospira pomona. These results were communicated March 16, 2022.*
>
> *This case highlighted the ability of the AHL to showcase the essential animal health testing services that they provide. Dr. Stalker worked on the storm day when the University was closed to*

process and read the histopathology and communications on a plan of action were also communicated with the OMAFRA meat inspector over a long weekend.

The pathologist ensured the timely reporting of the laboratory testing and the virologist worked to create a test compatible with genotyping to determine the causative serovar in a very short time period (3 weeks). The pathologists ensured throughout the investigation that the client (in this case this was OMAFRA's meat inspection) was notified of laboratory findings.

No where in this case summary is communication with the producer or their herd veterinarian noted. I am making the presumption that the producer would be notified directly through OMAFRA meat inspection, but this is not clear. Also, it was noted that a blood sample was required to run the genotyping confirmatory test, but this summary only provided information on the fact that tissues were submitted. Did the AHL contact the herd veterinarian or the producer to get access to this required sample? Or with the decision to run genotyping vs. serotyping did the AHL no longer require a blood sample? This could have been explained better. Due to the rarity of this diagnosis and any potential zoonotic precautions, both the vet and producer would have needed to be aware of this diagnosis ASAP, but I am unclear who's responsibility this was for this specific case. Expanding on further communications that happened would have been beneficial for the reviewers understanding of this case.

In summary I concur with the pathologists' assessment that, "This case demonstrates the utility of the AHL meat inspection histopathology service, with rapid detection and confirmation of an apparently uncommon condition in Ontario swine. The AHL response also highlighted the rapid development of a new test for genotyping Leptospira, a zoonotic pathogen".

C.2 Case 2: Ionophore Toxicity in Table Egg Laying Hens

AHL Cases G21-078031, G21-078545, and G21-080832

The case pathologist was Dr. Emily Martin.

Communications with client/industry
Thursday September 16, 2021 (afternoon). Dr. Brenna Tuer called about 25-week-old table egg hens treated previously for septicemia, but started to decline after treatment. Birds dropped off late in the afternoon (5 PM).

Friday September 17, 2021 at 9:36 AM – Dr. Brenna Tuer left message requesting rush postmortem on birds dropped off previous evening. Message left while Dr. Martin was doing the postmortem.

Friday September 17, 2021 at 9:48 PM. Returned Dr. Mike Petrik's call (left message on my cell at 9:04 PM Friday September 17, 2021). Dr. Petrik called in by Joyce Veterinary Services to consult on this case. Visited barn and says it looks like botulism symptoms (down birds, drooping heads). Called Dr. Tuer right after talking to Dr. Petrik (Friday September 17, 2021 at 9:54 PM) to relay discussion and testing plan based on Dr. Petrik's observations.

Saturday September 18, 2021. Dr. Tuer met the owner at AHL at 2 PM. Owner brought more birds for postmortem assessment. Dr Martin discussed case with owner and Dr. Tuer at drop off.

Tuesday September 21, 2021 at 12:52 PM. Dr. Brenna Tuer. Discussion if botulism could be toxico-infectious based on previous September case (G21-074507) from this farm that found necrotizing typhlitis and septicemia (*E. coli, E. cecorum*). No bacteria isolated from Friday postmortem case (21-078031) increased suspicion for botulism.

Tuesday September 21, 2021 at 1:27 PM. Conference call with Dr. Jess Walkey and Dr. Brenna Tuer. There is variability in paralysis among the birds, so concerned this could be a bacterial infection with *E. cecorum*. May submit more birds for bone swabs.

Wednesday September 22, 2021 at 11:12 AM. Dr. Walkey delivered more birds to the lab for bone assessment. Dr. Walkey observed postmortem and discussed case.

Wednesday September 22, 2021 at 4:56 PM. Dr. Walkey concerned about water testing results. Water taken was from a little-used tap. Variety of unusual bacteria and nothing > +1 in number. Need to go through and look at each bacteria and examine if they are environmental source. *Pseudomonas aeruginosa* could be from biofilm.

Friday September 24, 4:30 PM. Discussed second submission (G21-078545) with Dr. Walkey. Dropping off more feed samples on Friday evening.

Monday September 27, 2021 at 12:20 PM. Arranged for feed and meat meal to go to NVSL for botulism testing.

Tuesday September 28, 2021 at 3:45 PM. Dr. Walkey called to indicate toxic levels of ionophore (Salinomycin 130 ug/g) found in feed. Ionophores should not be in layer feed at all.

Wednesday September 29, 2021 at 11:35 AM. Discussion with Dr. Walkey about testing plan. Extra feed and meat meal will not be shipped to NVSL in the USA for botulism testing. Discussion re: egg testing. Birds are down to 40% production. Re-running feed to confirm ionophore toxicity. Serum was submitted and want to do biochemical testing.

Thursday September 30, 2021 at 9:44 AM. Biochemistry indicates massively increased CK levels. Along with Salinomycin in feed and histology lesions in G21-078545, suggestive of ionophore toxicity. Egg testing available in a lab in BC. Should get CFIA involved since there is a risk of ionophores in eggs from these birds. Eggs being held in refrigerated trailers and not sure which ones would be potentially affected.

Thursday September 30, 2021 at 12:32 PM. Run more biochemistry – 3 more.

Thursday September 30, 2021 at 2:32 PM. Dr. Walkey asked for an email with a summary of what is wrong with these birds and the food safety concerns.

Friday October 1, 2021 at 12:18 PM. Dr. Walkey indicated that they had talked to Dr. Lloyd Weber for advice on egg testing. He knew of the lab in BC. Yes, contact CFIA re: eggs.

Results reporting and turnaround times

Case G21-078031:

Received 10 live and 6 dead birds on Thursday September 16, 2021 at 5 PM. Live birds euthanized by postmortem technicians on arrival at AHL.

Dr. Brenna Tuer sent an email with further case summary (Thursday September 16, 2021 at 6:05 PM):

Hi Dr. Martin,

Thank you again for you and your team's accommodation to my submission this evening - I really appreciate it! Just wanted to provide a little more history for these birds. They are a flock of approximately 52,000 Lohmann layers around 28-29 weeks of age. I first saw them Friday Sept 3rd and diagnosed them with necrotic enteritis and coccidiosis. They were treated with BMD and Amprolium on label. I saw the birds again Monday the 13th, after about 5 days of BMD treatment, and the 4 birds brought in did not have any abnormal findings, and were in production. However, starting Tuesday, and correlating with the last load of medicated feed delivered, the bird's mortality increased from 3 birds on Monday to 7 birds/day. The producer reports egg production has dropped from 50,000 eggs Monday to 45,000 yesterday and feed consumption has dropped from 120g to 80g. He reports the birds as "laying down" and "quiet" in their enriched cages. They also reported "avocado green droppings".

Non-medicated feed is currently being mixed in and I was brought the 12 live birds and 4 dead. I was only able to open 2 birds quickly, just to have a peek at duodenum, to be able to get to AHL on time. Both looked within normal limits to me, with no focal necrosis or irritation, and I have attached photos below. Under Jess' advice, she recommended to leave the rest of the bird PM and submit with the others.

One person involved with this flock is specifically concerned about Infectious Bronchitis Virus as the flock had high titres (16500) around 20 weeks of age. We have subsequently taken a virology swab and new bloods submitted September 3rd (AHL #G21-074507). The swab came back negative and titres had dropped (8140); however, another virology swab (not with our practice) did test positive for IBV-USA strain.

I would appreciate your thoughts and recommendations on further diagnostics, including bone strength/pathology, after your necropsy. Thank you for your time and expertise!

Have a great night,

Brenna Tuer

DVM

Joyce Veterinary Services

Postmortem
Report authorized: 2021-Sep-17 13:12

Specimen received and date / time: Received 10 live chickens (euthanized on arrival) and 6 deceased chickens on Thursday September 16, 2021 at 5:00 PM.

Postmortem performed by: Dr. Emily Martin

Date and start / end time of post-mortem: Friday September 17, 2021 from 9:30 AM to 11:10 AM.

EXTERNAL FINDINGS:

LIVE (A to J): All birds have pale combs and are well feathered.

DEAD: All birds have pale combs and are well feathered. In addition:

K) Advanced postmortem decomposition.

N) Previously opened.

O) Previously opened.

P) Advanced postmortem decomposition.

BODY WEIGHTS:

LIVE: 1.7, 1.5, 1.5, 1.3, 1.5, 1.5, 1.2, 1.4, 1.5, 1.3 kg

DEAD: 1.3, 1.6, 1.4, 1.6, 1.2 kg

HYDRATION: Good

FAT: Excellent

MUSCLE: Excellent

INTERNAL FINDINGS:

LIVE:

A) There is fracture of the left femoral head. There is good medullary bone. The right lung is congested. The liver is dark red. This bird is in production with a good hierarchy of follicles on the ovary. There is a developing egg in the magnum (oviduct very thin, egg can be observed through the oviduct). The crop contains feed material.
B) There is good medullary bone. The caudal end of the keel bone moves freely. The liver is dark red and there is mild perihepatitis. This bird is in production with a good hierarchy of follicles on the ovary. The crop is empty.
C) There is fracture of the left femoral head. The ribs are infolded and the medullary bone is poor. The lungs are mildly congested. This bird is in production with a good hierarchy of follicles on the ovary. There is a shelled egg in the shell gland. There is a mixture of feed and fluid in the crop.
D) There is good medullary bone. The liver is dark red. This bird is in production with a good hierarchy of follicles on the ovary. There is a developing egg in the magnum.
E) There is good medullary bone. The liver is dark red. This bird is in production with a good hierarchy of follicles on the ovary. There is a shelled egg in the shell gland. There is fluid in the crop.
F) The liver is dark red. This bird is in production with a good hierarchy of follicles on the ovary. There is a shelled egg in the shell gland. There is fluid in the crop.

G) There is good medullary bone. The lungs are moderately congested. This bird is in production with a good hierarchy of follicles on the ovary. There is a developing egg in the magnum. There is feed material in the crop.
H) There is good medullary bone. The liver is dark red. This bird is in production with a good hierarchy of follicles on the ovary. There is a shelled egg in the shell gland.
I) There is good medullary bone. The liver is dark red. This bird is in production with a good hierarchy of follicles on the ovary. There is a developing egg in the shell gland. There is a cystic right oviduct. There is fluid in the crop.
J) There is good medullary bone. The liver is dark red. This bird is in production with a good hierarchy of follicles on the ovary. There is no egg in the oviduct. There is a mixture of feed material and fluid in the crop.

DEAD:

K) There is advanced postmortem decomposition. This bird is in production with a good hierarchy of follicles on the ovary. There is no egg in the oviduct.
L) There is good medullary bone. The lungs are mildly congested. The liver is dark red. There are remnants of internal lay. There is a cystic right oviduct. There is a tiny cyst attached to the infundibulum of the oviduct. This bird is in production with a good hierarchy of follicles on the ovary. There is a shelled egg in the shell gland. There is a mixture of feed material and fluid in the crop.
M) There is good medullary bone. The lungs are mildly congested. The liver is dark red. This bird is in production with a good hierarchy of follicles on the ovary. There is a developing egg in the magnum. There is a mixture of feed material and fluid in the crop.
N) There is good medullary bone. The lungs are mildly congested. This bird is in production with a good hierarchy of follicles on the ovary. There is a developing egg in the magnum.
O) This bird is in production with a good hierarchy of follicles on the ovary. There is a developing egg in the magnum. There is fluid in the crop.
P) There is advanced postmortem decomposition. This bird is in production with a good hierarchy of follicles on the ovary.

POSTMORTEM DIAGNOSIS: Pulmonary congestion

Additional tests requested: Bacteriology, virology and histopathology.

Tissues held: Lung, ova and proventriculus.

COMMENTS/INTERPRETATION:

On postmortem examination these birds are in excellent body condition, have excellent fat stores and are well feathered. The birds generally have good bone strength and there is medullary bone present. All birds are in production and many have developing eggs in the oviducts. There is some mild lung congestion and the livers appear congested. There is no splenomegaly. There are 2 oviducts that are transparent in the area of the magnum when surrounding developing eggs. There is general concern regarding an IBV infection. Since the spleens are not enlarged, a primary bacterial infection is unlikely.

Upon speaking with Dr. Tuer after postmortem examination, the increased morbidity and mortality in this flock was communicated. It was agreed that Influenza A and Newcastle Disease (APMV-1) PCRs would also be run on the lung/trachea tissue pool.

Emily Martin

Histopathology
Report authorized: 2021-Sep-23 22:07

LIVE (Slides A1 to A10):

TRACHEA. In 2 of 3 sections examined there are scattered to occasional mild clusters of mononuclear cells in the lamina propria.

LUNG. In the 3 sections examined there is moderate congestion. One of these sections has mild interstitial edema. In 1 section there are 2 mild clusters of mononuclear cells in the lamina propria of the secondary bronchus. In 1 section there are mild multifocal clusters of mononuclear cells adjacent to the parabronchial smooth muscle.

LIVER. In 1 of 3 sections examined there are mild multifocal accumulations of lymphocytes and plasma cells within connective tissue and adipose over the capsular surface and mild infiltration of the adjacent hepatic parenchyma. There is a single mild fibrin accumulation within the parenchyma.

SPLEEN. In 1 of 3 sections examined there are 2 areas with mild fibrin deposits. In 1 other section there are mild multifocal fibrin deposits.

CROP. In the 3 sections examined there are multifocal clusters of rod bacteria over the mucosal surface.

PROVENTRICULUS/GIZZARD. In 1 of 3 sections examined there is yolk peritonitis. In 1 section of proventriculus there are 2 moderate clusters of mononuclear cells in the interglandular connective tissue.

DUODENUM/JEJUNUM/ILEUM. In the sections examined there is yolk peritonitis. There are occasional myenteric nerves that have scattered lymphocytes and plasma cells.

MAGNUM. In 1 of 3 sections examined the lumen is filled with layers and globules of yolk material. There is scattered cellular debris along the outer margin. There are occasional small clusters of mononuclear cells in the glandular tissue.

SHELL GLAND. In the 3 sections examined there are occasional myenteric nerves that have scattered lymphocytes and plasma cells.

SKELETAL MUSCLE. In 2 of 7 sections examined there is mild perivascular accumulation of mononuclear cells. There are scattered myocytes that are fractured and have mild accumulation of mononuclear cells and heterophils.

SCIATIC NERVE. In 1 of 3 sections examined there are a few scattered lymphocytes and plasma cells within the nerve.

NOTE: Significant findings are not evident in sections of heart, kidney, pancreas, and tendon examined.

DEAD (Slides B1 to B8):

TRACHEA. In the single section examined there is mild accumulation of mononuclear cells in the lamina propria.

LUNG. In the 2 sections examined there is moderate congestion and mild interstitial edema. In the secondary bronchus there are moderate multifocal accumulations of mononuclear cells in the lamina propria. There are mild multifocal clusters of mononuclear cells adjacent to parabronchial smooth muscle.

LIVER. In 1 of 2 sections examined there is mild intrahepatic hemorrhage.

SPLEEN. In 1 of 2 sections examined there are rare tiny fibrin deposits within the parenchyma.

KIDNEY. In 1 of 2 sections examined there is 1 small cluster of mononuclear cells within the interstitium.

CROP. In the single section examined there are multifocal clusters of rod bacteria and scattered erythrocytes over the mucosal surface.

GIZZARD. In 1 of 2 sections examined there is a focal area of the mucosa with mild accumulation of heterophils and mononuclear cells in the lamina propria. There is focal erosion of the mucosal epithelium and focal moderate accumulation of cellular debris and heterophils in the overlying koilin. In the remaining section there are rare lymphocytes and plasma cells in the myenteric nerves.

MAGNUM. In 1 of 2 sections examined there is a focal moderate cluster of mononuclear cells within the glandular tissue.

SKELETAL MUSCLE. In 2 of 4 sections examined there is mild perivascular accumulation of mononuclear cells. There are scattered myocytes that are mildly fractured and have mild accumulation of mononuclear cells and heterophils.

NOTE: Significant findings are not evident in sections of heart, proventriculus, duodenum, pancreas, jejunum, ileum, ceca, shell gland, sciatic nerve, and tendon examined.

HISTOLOGIC DIAGNOSES:

- Peripheral neuritis (mild, live and dead)
- Tracheitis (mild, live and dead)
- Bronchitis (mild to moderate, live and dead)
- Lymphoplasmacytic hepatitis and serositis (1 section, live)
- Ventriculitis (mild, dead)
- Yolk peritonitis (live)
- Septicemia (live)

COMMENTS/INTERPRETATION:

On histopathology, there are lesions of peripheral neuritis that are mild in one section of sciatic nerve (live bird) and very mild in a myenteric nerve (dead bird). This may be suggestive of Marek's disease, however, further testing would have to be pursued in order to confirm this finding. Regardless, the mild nature of these lesions and minimal number of affected tissues identified would suggest that this is not the cause of the clinical paralysis and may be in incidental finding.

While there are trachea and bronchial lesions suggestive of IBV, the IBV PCR was negative.

The cause of the lymphoplasmacytic hepatitis and serositis is not known. The lesions of ventriculitis and yolk peritonitis are incidental findings.

Emily Martin

Bacterial culture:

Report authorized: 2021-Sep-21 11:25

Liver: No bacterial pathogens detected.

Liver: *C. hepaticus* PCR – negative

Virology:

Lung/trachea pool:

Negative APMV-1 (NDV) (Report authorized: 2021-Sep-17 18:11)

Negative Avian Influenza (Report authorized: 2021-Sep-17 16:03)

IBV PCR: (Report authorized: 2021-Sep-17 16:02)

Lung/trachea pool: IBV PCR – not detected

Kidney: IBV PCR – not detected

Oviduct: IBV PCR – not detected

Cecal tonsil – IBV PCR – positive

IBV sequencing: 85.9% to IBV_CU82792_AHL09-002204 (Report authorized: 2021-Sep-28 15:26)

Case Summary

Diagnosis: Infectious bronchitis (Best match: 85.9% IBV CU82792 AHL 09-002204)

On postmortem examination, these birds were in excellent body condition. All birds were in production. There was some mild lung congestion and the livers appeared congested. On histopathology there were lesions of peripheral neuritis. While this may be suggestive of Marek's disease, the mild nature of these lesions and minimal number of affected tissues identified would suggest that this is not the cause of the clinical paralysis. There were tracheal and bronchial lesions suggestive of IBV and the IBV PCR was positive on the cecal tonsil. On phylogenetic analysis, the best match: 85.9% IBV CU82792 AHL 09-002204. The Influenza A and APMV-1 (NDV) PCRs were negative. On bacterial culture there were no bacterial pathogens detected and the *C. hepaticus* PCR was negative. Overall, from this particular case, there is a diagnosis of IBV, however, further samples were submitted under case numbers 21-078545 and 21-079559 that have additional conclusions. Please see these cases for further comments.

Case G21-078545:

Additional birds received on Saturday September 18, 2021 for postmortem examination.

Postmortem:

Report authorized: 2021-Sep-20 10:28

Specimen received and date / time: Received 8 live chickens on Saturday September 18, 2021 at 2:12 PM.

Postmortem performed by: Dr. Emily Martin

Date and start / end time of post-mortem: Saturday September 18, 2021 from 2:30 PM to 3:30 PM.

EXTERNAL FINDINGS:

All birds are pale and well feathered.

Body Weights: Not taken due to blood/serum collection priority.

HYDRATION: Good

FAT: Excellent

MUSCLE: Excellent

INTERNAL FINDINGS:

All 8 birds have similar findings. All birds are in good body condition with excellent muscle mass and fat stores. All birds are in production but 5 have ovaries that are just starting to regress. Two of these birds and 2 other birds have shelled eggs in the shell gland. One other bird has a developing egg in the magnum of the oviduct.

POSTMORTEM DIAGNOSIS: OPEN pending further testing.

Additional tests requested: Virology, histopathology, botulism (US send out), water, feed (additive and mineral panel).

Tissues held: Multiple.

COMMENTS/INTERPRETATION:

On postmortem examination, these birds are in good body condition, are in production and the tissues generally look normal. Multiple samples have been collected and directed to the appropriate lab sections for testing. Serum and crop/gizzard content as well as feed will be sent for botulism testing in the US.

Emily Martin

Histopathology

Report authorized: 2021-Sep-23 22:08

SCIATIC NERVE. In 1 of 4 sections examined there are scattered to occasional mild clusters of lymphocytes and plasma cells within the nerves.

TRACHEA. In the 4 sections examined there are scattered mononuclear cells in the lamina propria. In 1 section there is a focal moderate accumulation of mononuclear cells in the lamina propria.

LUNG. The 4 sections examined are moderately congested. There are mild to moderate perivascular clusters of mononuclear cells in the interparabronchial connective tissue.

LIVER. In 1 of 5 sections examined there are mild multifocal accumulations of lymphocytes and plasma cells within connective tissue and adipose over the capsular surface and mild infiltration of the adjacent hepatic parenchyma. In 1 of these areas there are also 2 small granulomas.

DUODENUM/JEJUNUM. For each tissue, in 1 of 2 sections examined there is mild yolk peritonitis.

ILEUM/CECA. In 1 of 2 sections examined there is mild yolk peritonitis.

SKELETAL MUSCLE. In 5 of 6 sections examined there is 1 of 2 muscle bundles that has mild interstitial accumulation of edema as well as scattered mononuclear cells and heterophils. There is mild multifocal swelling, contraction, fracturing and occasional mineralization of myofibres. In the remaining section there is 1 of 2 muscle bundles with perivascular accumulation of mononuclear cells as well as mild multifocal swelling, contraction, and occasional fracturing of myofibres.

NOTE: Significant findings are not evident in sections of brain, brachial plexus, heart, spleen, kidney, pancreas, magnum, and shell gland examined.

HISTOLOGIC DIAGNOSES:

Peripheral neuritis (mild)

Lymphoplasmacytic hepatitis and serositis (1 section)

Yolk peritonitis (mild)

Myodegeneration (mild)

COMMENTS/INTERPRETATION:

On histopathology, as mentioned in the previous submission under case number 21-078031, the lesion of peripheral neuritis may be suggestive of Marek's disease, however, further testing would have to be pursued in order to confirm this finding. Regardless, the mild nature of this lesion and minimal number of affected tissues identified would suggest that this is not the cause of the clinical paralysis and may be in incidental finding.

The cause of the lymphoplasmacytic hepatitis and serositis is not known.

The myodegeneration noted in the skeletal muscle from the legs has changes indicating that this is of longer duration making ionophore toxicity less likely. It is more likely that this is from the birds being down on their legs for longer periods of time (hours). However, feed should be tested for ionophores to rule out this possibility.

Emily Martin

Bacterial culture

Report authorized: 2021-Sep-22 16:30

Water: Pre-treat: No bacterial growth

Powder out: *Ochrobactrum anthropi* 1+

Powder in: *Pseudomonas aeruginosa* 1+, *Brevundimonas aurantiaca* 1+, *Pseudomonas composti* 1+, *Pseudoxanthomonas mexicana* 1+

Virology

Report authorized: 2021-Sep-21 16:48

Avian Influenza PCR - negative

Toxicology

Feed additive screen

Report authorized: 2021-Sep-23 09:55

Salinomycin 130 ug/g (toxic level)

Mineral Panel/Heavy metal screen

Report authorized: 2021-Sep-28 14:51

No significant findings.

Request to re-run the feed additive screen on the feed sample. Emailed the Toxicology lab and Nick Schrier on Wednesday September 29, 2021 at 12:14 PM with request.

Clinical pathology

Biochemistry initially ordered on Wednesday September 29, 2021 at 1:22 PM (Specimen Room emailed to pull and direct sample.)

Report authorized: 2021-Sep-29 4:39 (2 serum samples)

Report authorized: 2021-Oct-1 12:00 PM (2 serum samples)

All samples – CK markedly increased

Botulism testing: (NOTE: Send out test to USA – NVSL)

Samples sent to NVSL for botulism testing the week of September 20, 2021.

Serum – Pooled: Not detected (Report authorized: 2021-Sep-29 07:49)

Feed/Crop content: Not detected (Report authorized: 2022-Feb-23 16:35)

Case summary

Diagnosis: Ionophore toxicosis

On postmortem examination these birds were in good body condition, in production and tissues generally looked normal. On histopathology, there was mild peripheral neuritis that could be suggestive of Marek's disease, however, the mild nature of this lesion and minimal number of affected tissues would suggest that this was not the cause of the clinical paralysis. The myodegeneration noted in the skeletal muscle from the legs had changes that could be suspicious for ionophore toxicity. In order to look for indirect evidence of muscle damage, serum biochemistry was pursued and creatine kinase (CK) levels were up to 150x normal range (on a diluted sample). This CK value confirmed severe muscle damage. Elevated levels of Salinomycin were detected on the Feed Additive Screen run on the submitted feed sample. On bacterial culture of submitted water samples, either no bacterial pathogens or only occasional organisms were identified. The Influenza A PCR was negative and botulism was not detected in the serum, crop content or feed samples. Overall, the lack of obvious postmortem lesions, the myodegeneration of adductor muscles on histopathology, the feed sample results of Salinomycin at 130 ug/g, and the high CK values combine to provide significant evidence to support a diagnosis of ionophore toxicity. This is the final report.

Case G21-080832:

Additional feed sample received on Saturday September 25, 2021 (dropped off after hours on Friday night and accessioned on Saturday morning).

Toxicology

Feed additive screen:

Report authorized: 2021-Oct-1-10:44

Salinomycin 130 ug/g (toxic level)

Mineral Panel/Heavy metal screen:

Report authorized: 2021-Sep-28 14:51

No significant findings.

Salt screen:

Report authorized: 2021-Oct-14 10:44

Communications – internal (AHL) and with other agencies (OMAFRA and CFIA)

Email with Dr. Felipe Reggeti on Thursday September 30, 2021 at 9:44 AM to 12:51 AM.

Discussion re: initial biochemical profile results. More information on additional samples and Dr. Reggeti gave advice on what samples to select for testing.

Email with Dr. Felipe Reggeti on Friday October 1, 2021 at 10:55 AM/reply at 11:50 AM.

G21-078545

Serum sample results: large variation in CK but lowest value around 89000.

Data had to be reviewed since multiple dilutions needed to do the testing as the results were too high otherwise.

Summary email to Dr. Tim Pasma (OMAFRA) on Friday October 1, 2021 at 11:30 AM.

Hi Tim,

I am not sure if you recall from the OAHN poultry meeting on Wednesday that Mike Petrik was talking about a layer flock that was suspected to have botulism. Since Wednesday, there has been testing come back that indicates this is actually ionophore toxicity (botulism testing was negative). The owner took out mortality and euthanized any clinical birds (paralysis). Approximately 20% of the flock was lost (biggest portion was selected culls due to clinical signs).

The case numbers are:

- 21-078031
- 21-078545 (most of the testing on this case)
- 21-080832 (another feed sample)

The key tests are the feed additive with Salinomycin at 130 ppm (ug/g) and the biochemistry that has a CK at super high levels.

Let me know if you have any questions. I am in my office today.

Thanks!

Emily

Communications with AHL clients

Re: Providing raw data for the feed testing results. (Email: Friday October 1, 2021 at 1:22 PM.)

Information on retesting provided by Nick Schrier by email on Friday October 1, 2021 at 11:58 AM.

Raw data results for the feed testing are:

126.7 and 126.4 ppm for the 130 ppm result reported

120.2 ppm for the 120 ppm results reported

Thank you! This is very helpful. Appreciate your time in going to extended lengths for details around this case. All the best, Jess (Friday October 1, 2021 at 10:52 PM)

Re: Request for summary of ionophore action to cause clinical signs. (Email: Friday October 1, 2021 at 1:53 PM)
Hi Jess,

I tried to boil down the biochemistry since it can vary between ionophores. Hopefully, the following makes sense.

Salinomycin is a polyvalent ionophore that is classified as monovalent and tends to bind readily to Na and K. Once bound to Na and K, the normal cation transport across cell membranes fails. The formed complexes with Na and K are lipid soluble.

More specifically, Salinomycin prefers to bind with K. The K leaving the cell is countered by movement of H into the cell causing intracellular acidosis. Other ionophores may have different binding affinities.

The ionophores tend to cause lesions in muscles with red fibres (i.e. type I slow twitch fibres, adductor muscle) or in muscles that are a mixture of red and white fibres. Red fibres use aerobic (oxidative) catabolism for energy production. There are various muscles that are classified as red or mixed fibre type.

Ionophores are poorly absorbed by the intestines and up to 80% are excreted. The remainder is rapidly absorbed from the intestines and widely distributed to the tissues. This allows accumulation in tissues, especially in tissues with higher fat content.

Let me know if you need any more information.

Thanks!

Emily

From: Dr. Jess Walkey (Email: Friday October 1, 2021 at 10:18 PM.)

Hi Emily,

Thank you SO much for taking the time to break this down for me. Truly appreciate your insights. I will keep this for myself and team's learning only. That all makes total sense and helps. Thank you again!

All the best, Jess

Follow-up required from diagnostic conclusion
Wednesday September 29, 2021 at 2:18 PM.

Information on testing table eggs for ionophores received from Katherine Vaccaro of Merieux NutriSciences (testing done at Burnaby, BC lab).

Final resolution from AHL perspective
The final diagnosis on this case was ionophore toxicosis. It demonstrates the availability of AHL Pathologists to respond to veterinarians and producers requiring prompt diagnosis of high consequence poultry production losses, including evenings and weekend service if necessary. Once the diagnosis of ionophore toxicosis was confirmed, the information allowed the vets, owner, feed company and egg grading station to work towards determining the food safety of the eggs being held from this flock.

Review of the Case by OMAFRA

The following is a review of the summary report by OMAFRA.

> *These cases involve a flock of 52,000 layers hens, 28-29 weeks of age, with a history of diagnosis of septicemia, but increasing mortality and decreasing production following treatment. Several differential diagnoses were considered in the case, including botulism, Enterococcus cecorum, infectious bronchitis virus and Marek's disease. Case 21-078031 identified infectious bronchitis virus as a cause, the second case 21-078545 diagnosed an ionophore toxicity based on lack of*

postmortem lesions, evidence of muscle damage on histopathology and biochemistry and salinomycin identified in a feed sample as well as a feed sample submitted for case 21-080832.

In these cases, there was timely notification of regulatory agencies as both OMAFRA and CFIA were notified of the diagnosis. These notifications were important as there were food safety concerns with the eggs produced by the flock.

I agree with the assessment in the report that these cases demonstrate the availability of the pathologists and lab to respond out of hours to situations of high morbidity and mortality in the poultry sector. The pathologist handled the submission of samples brought in on the weekend and responded promptly to out of hours communications from veterinarians involved in the case.

These cases also demonstrate the commitment of the pathologist to determining a diagnosis in this challenging case and working with multiple samples to obtain a diagnosis. It also demonstrates the capacity of the lab to handle cases through connections with other laboratories. Although samples were never tested, the lab was able to arrange testing for botulism at the USDA NVSL and for testing of eggs for ionophores from a lab in Burnaby.

It should be noted that a test for botulism was available previously at AHL but has been discontinued. However, it is my understanding that there is a project proposal through OAHN to develop a new botulism test.

C.3 Case 3: Arthrogryposis and Skeletal Malformations in Newborn Calves – OAHN Bovine Trace Mineral Project

AHL Cases G22-027421 and G22-028603

The case co-ordinators were Dr. Meegan Larsen and Dr. Siobhan O'Sullivan, University of Guelph Anatomic Pathologists.

AHL Case G22-027421

April 5, 2022 08:21 – AHL Postmortem received a malformed calf born April 4/2022 from a herd of 100 Hereford cattle. Dam is a heifer, full term pregnancy due to A.I - breeding. "Perform the tests for the OAHN Trace Mineral project please."

Postmortem Report

Postmortem performed by: Dr. Larsen and authorized April 5, 2022 17:59

Time of postmortem: 05/04/22

Fetus: Received is a black female fetus with a full haircoat, erupted incisors and a crown-rump length of 69 cm. There is meconium tinted mucus adhered to the skin multifocally. The limbs are markedly shortened and curve medially with both hocks and both elbows locked in flexion. The head is markedly domed and the snout is shortened such that the maxilla is shorter than the mandible (brachygnathia superior). There is abnormal curvature of the lumbar spine (kyphosis). The hard and soft palates are closed.

Placenta: The placental is grossly unremarkable.

INTERNAL FINDINGS:

The long bones of the limbs are markedly shortened and thickened. The liver is mildly firm with red and tan mottling throughout. The thyroid glands are normal in size. The brain is grossly unremarkable.

POSTMORTEM DIAGNOSIS:

Skeletal abnormalities including lumbar kyphosis, arthrogryposis of the hocks and elbows, superior brachygnathism, medial bowing and shortening of the long bones of the limbs, doming of the skull and dwarfism.

Comment / interpretation: The overall gross appearance is consistent with a near term fetus despite the short crown-rump length which is likely a reflection of the generalized skeletal abnormalities. The abnormalities are severe enough to be incompatible with life. The meconium-stained mucus on the fetus suggests some degree of fetal distress in utero. Congenital skeletal abnormalities in bovine fetuses can result from acquired [nutritional/teratogenic, viral (e.g., BVDV)], and genetic causes. Differentiation between these causes cannot be done based on gross examination alone and often requires detailed historical data and examination of many affected animals in the case of a herd outbreak.

Additional tests requested: Trace mineral panel on liver, bacterial culture of lung, abomasal fluid and placenta, histology

Tissues held: Liver, lung, kidney, brain, thoracic fluid, abomasal fluid

Histopathology Report – Date authorized April 12 2022 09:28

Liver (4 sections, slides 1-3): Portal triads are subjectively closely spaced and expanded by slightly increased numbers of bile duct profiles. Triads occasionally bridge with one another via immature bile ducts and thin strands of fibrous connective tissue. In some areas, sinusoids in zones 2 and 3 are distended and blood-filled and hepatic cords are thin and discontinuous. In one section, there is a discontinuous rim of subcapsular fibrosis with isolated bile ducts, lymphatics and small clusters of hepatocytes.

Masson's Trichrome stain for collagen shows strands of collagen bridging between some portal tracts.

Sections of kidney, lung, spleen, thymus, adrenal and thyroid gland, placenta, brain, abomasum, small and large intestine, heart, eyelid and skeletal muscle were also examined and found to be histologically unremarkable.

HISTOLOGIC DIAGNOSIS

Liver: Mild generalized portal biliary hyperplasia and lobular atrophy with inconsistent bridging fibrosis and regionally extensive sub-capsular fibrosis

Bacterial culture: no bacterial or fungal pathogens detected in lung/abomasal content/placenta – authorized April 8 12:29.

BVDV RT-PCR: Negative - authorized April 8 21:53

Bovine abortion panel PCR: Negative for BHV-1, *Leptospira, Neospora* – authorized April 13 17:48

Date Authorized: 2022-Apr-08 16:39

Sample ID	Client Sam ID	Specimen	Test	Result		Interval	Note
22-027421-0003	NO ID	Liver	Cobalt	0.013 L	ug/g	0.020-0.085	
22-027421-0003	NO ID	Liver	Copper	84	ug/g	25-100	
22-027421-0003	NO ID	Liver	Iron	70	ug/g	45-300	
22-027421-0003	NO ID	Liver	Manganese	0.95 L	ug/g	2-6	
22-027421-0003	NO ID	Liver	Molybdenum	0.26	ug/g	0.14-1.4 (fetus 0.9 – 1.8 ug/g)	
22-027421-0003	NO ID	Liver	Selenium	0.30	ug/g	0.25-0.5	
22-027421-0003	NO ID	Liver	Zinc	110 H	ug/g	25-100	

Bluetongue virus PCR: Negative – authorized April 21 16:32
Epizootic Hemorrhagic Disease virus PCR – authorized April 21 16:32
Cache Valley VN: Inconclusive for CVV – authorized April 29 15:46. Subcontracted to TVMDL, Texas, USA

AHL Case G22-028603

April 7, 2022 13:29 - AHL Postmortem received a bovine fetus from a herd of 100 Hereford cattle. Owner reports pulled calf this morning, calf was backwards, limbs and head deformed similarly to previous calf submission.

Postmortem Report

Postmortem performed by: Dr. O'Sullivan and authorized April 7, 2022 20:02

Time of postmortem: 14:00-15:00, 07/04/22

EXTERNAL and INTERNAL FINDINGS:

A male bovine fetus without placenta is presented for examination. The fetus has a crown rump length of 76 cm (>8 months gestation), and is fully haired, with intact eponychia, and erupted teeth. There is generalized meconium staining over the body surface.

The skull and snout are deformed; the calvarium is domed, the eyes are widely spaced and bulging and the maxilla is short (brachygnathia superior). The lateral ventricles of the brain are subjectively mildly dilated. There is lordosis and scoliosis of thoracic vertebrae. The limbs are notably short and stunted, medially angled, and fixed in a flexed position (arthrogryposis).

There are multifocal petechial hemorrhages in the subcutis under the mandible, and mucosa of the pharynx and proximal esophagus. The cervical portion of the thymus is diffusely dark red and edematous (hemorrhage). There is abundant serosanguinous thoracic fluid; the lungs are pink/red and soft. The right atrium of the heart is dilated.

There is abundant serosanguinous abdominal fluid. The liver is firm, with an irregular, mottled brown/purple surface and a prominent zonal pattern on cut section. There are multiple small tortuous vessels and multifocal mesenteric hemorrhages present at the hilus of the liver. There is multifocal to coalescing serosal hemorrhage over the duodenum and spiral colon, and generalized, transmural hemorrhage of the ileum which is diffusely dark red.

POSTMORTEM DIAGNOSES:

- Whole body: Fetal malformation (Arthrogryposis, scoliosis/lordosis, superior brachygnathia)
- Liver: Hepatopathy (suspect fibrosis, acquired shunts)
- Heart: Right atrial dilation
- Thymus: Marked hemorrhage
- Gastrointestinal tract/abdomen: Marked ileal hemorrhage, multifocal serosal/mesenteric hemorrhages

COMMENT:

This is a malformed fetus with unusual hepatopathy and distribution of hemorrhages; viral testing may be warranted in addition to the allowances made for culture. Histopathology is pending, and will direct the recommendations for diagnostic testing. Liver for mineral analysis is the only testing routed at this time.

Tissues held:

Frozen: Lung, liver, kidney, thoracic fluid, abomasal fluid, thymus, spleen, lymph node, ileum, heart valve, colon, small intestine.

Formalin-fixed: Various

Histopathology Report – Date authorized April 15 2022 15:38

Liver (Slide 2, 4, 5): Portal triads are hypercellular; there is ductular reaction, and increased number of small caliber vessels. Interstitial, portal-portal fibrosis is suspected (trichrome pending). There is mild centrilobular sinusoidal congestion.

Ileum (Slide 5, 6, 7): There is generalized congestion of submucosal, mucosal and mesenteric vessels, with occasional perivascular hemorrhage, and mucosal edema. Peyer’s patches are cellularly robust.

Thymus (Slide 1, 2): Erythrocytes are prominent in the medulla (congestion/hemorrhage). There is multifocal interstitial hemorrhage. Lymphoid tissue is robust.

Lung (Slide 4, 5): There is variable atelectasis. Alveoli can contain proteinaceous fluid and occasional squames.

Histologic lesions are not evident in : Salivary gland (Slide 1), Lymph node (Slide 2, 3),Adrenal gland (Slide 3), Kidney (Slide 3), Spleen (Slide 5), Umbilicus (Slide 6), Ileum (Slide 6), Esophagus (Slide 6), Rumen (Slide 7), Colon (Slide 7), Small intestine (Slide 7), Abomasum (Slide 8), Skeletal muscle (Slide 8), Trachea (Slide 8), Omasum (Slide 8), Urinary bladder (Slide 8), Heart (Slide 9), Brain (Slide 10, 11)

HISTOLOGIC DIAGNOSES:

Liver: Hepatic fibrosis

Ileum: Generalized congestion

Thymus: Congestion/hemorrhage

Lung: Amniotic aspiration

COMMENT:

Histologic lesions do not suggest a specific underlying cause of fetal malformation. Tissues from this submission are negative for BVDV, BHV-1, *Neospora* and *Leptospira* by PCR. The trace mineral panel is pending.

BVDV RT-PCR: Negative - authorized April 8 21:53

Bovine abortion panel PCR: Negative for BHV-1, *Leptospira, Neospora* – authorized April 13 17:48

Trace element tissue:

Date Authorized:	2022-Apr-19 16:01					
22-028603-0003	DUNSMORE CALF	Liver	Copper	40	ug/g	25-100
22-028603-0003	DUNSMORE CALF	Liver	Iron	50	ug/g	45-300
22-028603-0003	DUNSMORE CALF	Liver	Manganese	0.93 L	ug/g	2-6 (fetus 0.9 – 1.8 ug/g)
22-028603-0003	DUNSMORE CALF	Liver	Molybdenum	0.26	ug/g	0.14-1.4
22-028603-0003	DUNSMORE CALF	Liver	Selenium	0.18 L	ug/g	0.25-0.5
22-028603-0003	DUNSMORE CALF	Liver	Zinc	170 H	ug/g	25-100

Bluetongue virus PCR: Negative – authorized April 21 16:32

Epizootic Hemorrhagic Disease virus PCR – authorized April 21 16:32

Cache Valley VN: Negative for CVV – authorized April 29 15:39. Subcontracted to TVMDL, Texas, USA

Communications – internal (AHL) and with the client (OMAFRA)

2022-April 7 09:08: Dr. Miltenburg emailed Dr. Fairles, Dr. Larsen and referring veterinarian to review testing and alert a second calf being submitted for postmortem.

Good morning Jim and Meegan,
I was speaking with Phil Meadows (herd vet) on this case (22-027421) this morning. Since BVD was mentioned as a possible cause, if it is possible and warranted to add a BVD test to the submission, the OAHN project funding can cover that.
FYI - A second calf from the same herd is on its way to AHL with the same presentation. May make sense to add the BVD test to that submission as well?

Thanks to both of you for your assistance with the OAHN project submissions.
Cynthia Miltenburg, DVM, DVSc.

2022-April 7 09:55: Dr. Larsen replied to Dr. Miltenburg, Dr. Fairles and Dr. Meadows:

Good morning Cynthia,

Yes, I think that running a BVD PCR would be a good idea for this case. This was my first trace mineral project submission and I didn't want to exceed the cost limit but with your okay I will add the test.

Best, Meegan

2022-April 8 10:59: Dr. Fairles emailed Dr. Miltenburg, Dr. Larsen and Dr. O'Sullivan re pathology rounds discussions:

Hi Cynthia – at rounds today we discussed this case and the new one that Siobhan is doing

And will do BVD on both.

Manganese deficiency came up in discussion as well.

Is there a plan in this project to do matched controls?

E.g. other abortion workups not related to the project to do liver mineral panels as well?

Thx, Jim

2022-April 12 11:06: Dr. Miltenburg emailed Dr. Fairles, Dr. Larsen and Dr. O'Sullivan with additional clinical information and questions:

Hi Jim, Meegan and Siobhan,

I talked to Phil (herd vet) this morning. He is going to try and get more nutritional information. This is the second year in a row that the herd has had this issue – only in heifers, calves from cows are unaffected. We are working on getting more nutritional and bull breeding information. There have been 6 calves born from the heifers so far – 1 was an abortion a few weeks early and was disposed of, 4 have been born malformed and died (first 2 were submitted, 2 more have been born this week that were not submitted), and 1 born alive but has shortened legs.

What were you thinking in terms of matched controls? Other calves on the farm? Phil and I were discussing the merit of liver biopsies on the heifers, but recognize that these may now be unremarkable if the "insult" has passed.

I would appreciate any suggestions you have in terms of other investigation to pursue regarding the herd.

Thanks, Cynthia

2022-April 14 09:15: Email from Dr. Fairles to Dr. Miltenburg, Dr. Larsen, Dr. O'Sullivan, Dr. Spinato, Ms. Zoethout:

Hi Cynthia and all – I talked briefly to Siobhan and for that case it looks like we have the appropriate samples to send for CVV. (VN and possibly PCR)

Schmallenburg would take the cooperation of CFIA NCFAD.

Cynthia – one thing I forgot to mention – if we do pursue this for CFIA – we will need specific permission from the vet (and implied from owner) to send all the report information to CFIA. (OMAFRA permission obvious – You are talking to Cathy). There might? be consequences to a positive (even if remote)

Copied Maria and Jenn re send out if needed.

Thx Jim

2022-April 14 12:00: Dr. Miltenburg emailed with request to rule out Cache Valley and Schmallenberg viruses:

Hi Meegan, Siobhan and Jim,

I am working on getting a herd visit set up to investigate nutritional and genetic risk factors more closely with the herd vet. In the meantime, I did want to discuss with you the appropriateness of ruling out Cache Valley virus and Schmallenberg virus. Although I think a nutritional cause is much more likely, I've been thinking about the possibility of orthybunyviruses. Granted we have never had Schmallenberg, but with the detections of Cache valley in sheep, and EHD in deer, risk for diseases spread by Culicoides generally may be changing.

I have not spoken to the herd veterinarian about testing for these, I wanted to get your opinion on the appropriateness. I don't want to be alarmist, but an "outbreak" of arthrogryposis might be where ruling these out is reasonable. Thoughts? I would also look to you for appropriate test selection and if samples exist.

With thanks, Cynthia

2022-April 14 12:53: Dr. Miltenburg emailed Dr. Spinato, Dr. Fairles, Dr. Larsen, Dr. O'Sullivan, Ms. Zoethout:

Thanks Maria. Yes, the submissions are calves. All of the abnormalities are skeletal in nature – 5 abnormal calves and one abortion. In your opinion is it appropriate to look for CVC or Schmallenberg? I don't want to pursue testing for diseases that are not really a risk. I just wanted to discuss whether they are appropriate to consider in a case like this given the congenital abnormalities. I have not mentioned this to the vet (of course would to get permission to do the tests). My primary concerns are nutrition and genetic, I just want to consider all possibilities.

I appreciate any and all thoughts.

Thanks, Cynthia

2022-April 14 16:20: Dr. Spinato replied to Dr. Miltenburg, Dr. Fairles, Dr. Larsen, Dr. O'Sullivan, Ms. Zoethout re arranging a group meeting via Teams to review findings and determine best testing options to pursue:

Cynthia, I agree with your top differentials of nutritional and genetic factors.

However, we can still pull some references for viral etiologies involved in arthrogryposis outbreaks and compare the descriptions of lesions with those described in our recent PM cases. Shall forward these to you.

Then we can arrange a quick Teams meeting early next week and arrive at a group consensus re value of pursuing additional testing.

Hope this works for everyone. Have a good long weekend, Maria

2022-April 14 18:00: Dr. Miltenburg emailed Dr. Miltenburg, Dr. Fairles, Dr. Larsen, Dr. O'Sullivan, Ms. Zoethout re approval of group meeting:

Thanks Maria. I think that sounds like an excellent plan. Will be in touch next week.

Cynthia

2022-April 19 09:24: Dr. Spinato emailed Dr. Miltenburg, Dr. Fairles, Dr. Larsen, Dr. O'Sullivan to provide 3 review articles as background information (*1. Skeletal muscle hypoplasia represents the only significant lesion in peripheral organs of ruminants infected with Schmallenberg virus during gestation; 2. Salient lesions in domestic ruminants infected with the emerging so-called Schmallenberg virus in Germany; 3. Virus-induced congenital malformations in cattle*) and to set up a meeting to review additional testing options:

Hi Folks;

Let's meet as discussed last week to review options and make a decision regarding additional ancillary testing for these deformed calves.

I have these days/times free this week:

Tues: 11-12, 1-3

Wed. 9-10, 12-3, 4-5

Let me know what works for you and we'll set up a Teams meeting.

Thanks, have a good one. Maria

2022-April 20 09:00: Teams meeting with Dr. Miltenburg, Dr. Fairles, Dr. Larsen, Dr. O'Sullivan and Dr. Spinato to review progress on postmortems to date, discuss references and plans for additional testing. Agreement to proceed with Cache Valley virus and Schmallenberg virus testing, although lesions in calves not very typical of these viral infections. However, all agreed this complex case warranted a full complement of testing, including rare and foreign viral etiologies.

2022-April 20 10:02: Dr. Larsen emailed Dr. Reggeti and Dr. O'Sullivan requesting interpretation of manganese levels:

Hi Felipe,

Siobhan and I have both received stillborn calves from the same farm over the past few weeks. Both calves had skeletal deformities. Siobhan's calf was of normal size, but mine (22-027421) was dwarfed. This is a herd problem among heifers. The manganese was low in both calves (0.9 and 0.95). We have been discussing the possibility of congenital nutritional chondrodystrophy associated with manganese deficiency in the heifers. Can you give us your thoughts on interpreting the manganese levels in these stillborn calves? Would you consider them low for stillbirths/fetuses?

Cobalt was also low in my calf and zinc was high. Any other thoughts related to the panel results would be helpful.

Siobhan, please add anything relevant that I have forgotten to mention.

Thanks! Meegan

2022-April 20 10:12: Dr. O'Sullivan emailed Dr. Reggeti and Dr. Larsen with results of tissue mineral panel testing:

Here are the two reports for comparison Felipe; both calves low cobalt and manganese and high zinc, and my calf also has low Selenium. We had a meeting this morning with Jim, Maria and Cynthia from OAHN who's involved; we'll be doing viral rule outs for these cases but there's a strong suspicion that these are related to nutritional issues (history of subpar feed given to the affected heifers in midgestation). Likely there's nothing that can be definitively proven at this point, but we'd be interested to hear your thoughts on the mineral panel results.

Thank you, -Siobhan

2022-April 20 11:12: Dr. Reggeti responded to Dr. Larsen, Dr. O'Sullivan, Dr. Miltenburg, Dr. Fairles and Dr. Spinato:

Hi Meegan and Siobhan,

Meegan, as you indicated, these results are within reference limits for fetus/newborn (both are > 0.9 ppm), but this does not eliminate the chance that these animals could have been fed a Mn deficient diet at a critical time of pregnancy, which is now corrected. As it is frequent in these cases, the diagnosis is supported by ruling out other causes of skeletal deformity and subsequent response to Mn supplementation in future pregnancies. As Siobhan mentioned, a poor quality diet was given to this animals during pregnancy, so nutritional imbalance is possible.

At the last AAVLD meeting, Dr. Jeffrey Hall (used to be in Utah), who is an authority in trace minerals, gave an interesting talk on the subject. Five different herds of cows with >40% of calves born dwarf and about 25% deaths within 3 days. Short legs and weak and lax joints. Each herd used different bulls (i.e. no obvious genetic component) and poor quality silage represented a high % of the diet (40-60%). Liver Mn 1.2-1.6 ppm (RI adult 2-6 ppm; fetal/newborn 0.9-4.5 ppm). Low Vit A. Michigan extension report documented similar cases presumably due to low Mn and Vit A. Dr. Hall questioned the significance of Mn in the cases presented here, as Mn is WRI, but also discussed the possibility of Mn deficiency during first trimester of gestation that was later corrected.

Another topic of interest is bioavailability. Even if the dietary requirements are met (beef cattle: 20 mg/kg of diet and dairy cattle: 40 mg/kg of diet – NRC, 2005), absorption could be influenced by mineral interactions. High Ca and P have been shown to increase the severity of Mn deficiency. Other minerals/ration constituents may also affect. Consultation with a nutritionist may be helpful.

The matrices most commonly tested to evaluate Mn status are liver, whole blood and serum. Of these, serum seems to be the most sensitive to changes in intake (at least in sheep – Herdt and Hoff), so this might be a way to monitor Mn intake and bioavailability in pregnant cows. Mn is in high concentration within the RBC so if serum Mn is to be tested, the samples must be devoid of hemolysis and the serum has to be transferred to a clean transport tube soon after clot formation (within an hour?) to avoid "contamination" of the serum sample with RBC Mn. Checking vitamin A might also be informative.

I would say the changes in Co and Zn are unrelated. Felipe

Final resolution from the AHL perspective

AHL Veterinarians, Pathologists and Toxicologist worked together as a team with Dr. Miltenburg to provide comprehensive analytical testing of the submitted bovine fetuses in order to identify a cause for the congenital malformations in this herd. Common (BVDV, BHV-1) and less common (Bluetongue, EHDV, CVV) viral infections were ruled out; Schmallenberg testing was referred out to CFIA and results are still pending. Challenges with determining cause of stillbirth/abortion and fetal malformations exist because the insult (viral, nutritional) often occurs in the early stage of gestation and the virus is cleared or the nutritional imbalance can be corrected by the time testing takes place. Additional work is required to confirm normal level of manganese in bovine fetuses and newborn calves so this suspected etiology for congenital malformations can be confirmed or ruled out in future cases.

Review of the Case by OMAFRA

The following is a review of the summary report by Dr. Cynthia Miltenburg, OMAFRA on June 22, 2022.

> *The reports by Drs. Larsen and O'Sullivan summarize a case of congenital skeletal abnormalities in bovine fetuses from a cow-calf herd in the spring of 2022. Through the OAHN project, the herd veterinarian coordinated the submission of an abnormal fetus that required producer assistance to deliver. Subsequently a similar second fetus was identified two days later and submitted. The submissions were facilitated quickly by Dr. Fairles and assigned to the OAHN project funds.*
>
> *The OAHN project had initially set out a panel of testing to be completed on each submission (postmortem, histology, bacterial culture, and trace mineral testing) which the pathologists Drs. Larsen and O'Sullivan easily facilitated. The herd veterinarian and OAHN project contacts promptly received the results from the initial postmortem and histology. After follow-up from Dr. Miltenburg to Drs. Fairles and Larsen, Dr. Larsen added testing for BVDV to the diagnostic investigations. Discussion among the pathologists at routine case rounds encouraged the further addition of testing for the panel of abortion etiologies which was communicated to Dr. Miltenburg and the herd veterinarian by e-mail, and subsequently added.*
>
> *With no definitive cause identified through the testing to date, Dr. Spinato and others promptly responded to an inquiry from OMAFRA to discuss if any further diagnostics were necessary. A group meeting that included the case pathologists, Dr. Spinato, Dr. Fairles, and Dr. Miltenburg was arranged. The pathologists presented several papers reviewing viral etiologies for arthrogryposis. After discussion, the group agreed additional testing was warranted. Additionally, Dr. O'Sullivan followed up with toxicologist Dr. Regetti to further review the findings on the trace mineral panels. All subsequent viral testing was completed within a few days, however Schmallenberg testing requested of CFIA is delayed due to CFIA's demands for Avian Influenza response.*
>
> *The collaboration between pathologists to consult the literature to understand other possible etiologies was admirable. The investigation has been comprehensive to systematically rule out viral causes of congenital skeletal abnormalities. The pathologists have also investigated nutritional (trace mineral) abnormalities while clearly acknowledging the limitations for detecting an insult that may have been mid-gestation (months ago) and since corrected. Great effort was made to corroborate findings between the two submissions and to meet the testing priorities of a research project and OMAFRA and keep all parties informed of the results.*

APPENDIX D AFL CONTRIBUTIONS TO KTT AND HQP DEVELOPMENT

The list of AFL's publications, presentations, research projects, contributions, and training of HQP in 2021/22 is provided below. It offers evidence of AFL's competence and willingness to further develop its technical capacity, adding to the public confidence in the Agriculture and Food Laboratory.

D.1 KTT Contributions

D.1.1 Journal Publications

In Press

1. Justin M. Renkema, Wendy McFadden-Smith, Shu Chen. Semi-quantitative detection of Drosophila suzukii (Diptera: Drosophilidae) from bulk trap samples using PCR technology. Journal of Economic Entomology. 2022, 1–9. https://doi.org/10.1093/jee/toab258.
2. Dele Ogunremi, Ruimin Gao, Rosemary Slowey, Susan Nadin-Davis, Shu Chen, Olga Andriesvakaia, Sadjia Bekal, Jane Parmley, Lawrence Goodridge, Roger C. Levesque. Tracking Salmonella Enteritidis in the genomics era: clade definition using a SNP-PCR assay and implications for population structure. Book Chapter, IntechOpen, Octpber 14, 2021. https://www.intechopen.com/chapters/77305.
3. M Melzer and X Shan. Diseases diagnosed on plant samples submitted to the Plant Disease Clinic, University of Guelph in 2021. Canadian Plant Disease Survey, 2022.
4. Carolina Varilla, Massimo Marcone, Lisete Pavia and Jose Baptista. Bromelain, a Group of Pineapple Proteolytic Complex Enzymes (Ananas comosus) and Their Possible Therapeutic and Clinical Effects. A Summary. 2021. https://doi.org/10.3390/foods10102249.
5. N. Botten, L.J. Wood, J.R. Werner, Glyphosate remains in forest plant tissues for a decade or more, Forest Ecology and Management, Volume 493, 2021, 119259, ISSN 0378-1127, 2021. https://doi.org/10.1016/j.foreco.2021.119259.

To Be Submitted

1. Carlos G. Leon-Velarde, Jeanine Boulter-Bitzer, Susan Lee, Nicola Linton, Kelly Shannon, Anli Gao, Jiping Li, Saleema Saleh-Lakha, Shu Chen. Evaluation of Microbial Quality and Safety of Sushi Sold in Ontario Restaurants and Groceries using Combined Culture and Molecular Methods. To be submitted to International Journal of Food Microbiology.
2. Anli Gao, Jennifer Fischer-Jenssen, Durda Slavic, Kimani Rutherford, Sarah Lippert, Emily Wilson, Shu Chen, Carlos Leon-Velarde, Perry Martos. Serotype Salmonella Enteritidis and Typhimurium by Matrix Assisted Laser Desorption Ionization-Time of Flight Mass Spectrometry (MALDI-TOF MS) through Multivariate Analysis and Artificial Intelligence. To be submitted to Journal of Clinical Microbiology.

D.1.2 Oral Presentations

1. Matthew Quinn, Nicola Linton, Carlos G. Leon-Velarde, Shu Chen. Evaluation of a new metabarcoding method and its application to uncover diversity and prevalence of Salmonella

serovars in Ontario poultry production environments. Video presentation for the 65th OFPA Annual Spring Technical Meeting & Clive Kingsbury Video Competition, April 14, 2022.

2. Linda Lissemore, Guest Lecturer, University of Guelph – Pesticides in the Environment course, January 2022.
3. Andrew Moore. Canin Cystoliths. Royal Canin Virtual Panel Discussion: Navigating the Hard Diagnosis of Urolithiasis. September 22, 2021. https://promos.royalcanin.com.au/vets/webinar/navigating-the-hard-diagnosis-of-urolithiasis.

D.1.3 Poster Presentations

1. Leon-Velarde, Carlos G., Jeanine Boulter-Bitzer, Susan Lee, Nicola Linton, Kelly Shannon, Anli Gao, Jiping Li, Saleema Saleh-Lakha, Shu Chen. Evaluation of Microbial Quality and Safety of Sushi Sold in Ontario Restaurants and Groceries using Combined Culture and Molecular Methods. IAFP. July 18-21, 2021. Phoenix, Arizona.
2. Saleema Saleh-Lakha, Carlos Leon-Velarde, Nathan Larson, Ryan Lee, Zheng Wu, Sophie Canobio. Evaluation of the bioMérieux GENE-up® Salmonella 2 (SLM 2) Real-Time PCR Assay for Salmonella in a Variety of Foods. IAFP. July 18-21, 2021, Phoenix, Arizona.
3. Saleema Saleh-Lakha, Carlos Leon-Velarde, Nathan Larson, Ryan Lee, Zheng Wu, Sophie Canobio. Evaluation of the bioMérieux GENE-UP® Listeria monocytogenes (LMO 2) Real-Time PCR Assay for the Detection of Listeria monocytogenes in a Variety of Foods. IAFP. July 18-21, 2021. Phoenix, Arizona.
4. Saleema Saleh-Lakha, Carlos Leon-Velarde, Nathan Larson, Ryan Lee, Jennifer Fischer-Jenssen, Sophie Canobio. Evaluation of the Biomérieux VIDAS® Listeria monocytogenes (LMX) Enzyme-based Immunoassay for the Detection of Listeria monocytogenes in a Variety of Foods. IAFP. July 18-21, 2021. Phoenix, Arizona.

D.1.4 Research Projects (Grants)

1. Shu Chen (PI), Team members: Susan Lee, Saleema Saleh-Lakha, Carlos Leon-Velarde, Mythri Viswanathan, Nicola Linton. Comprehensive evaluation of a high throughput culture-independent diagnostic test (CIDT) against standard methods for simultaneous detection of common food-borne pathogens in foods. Proposal submitted to Ontario Agri-Food Research Initiative Program (OMAFRA). December 2020-present.
2. Shu Chen (PI), Carlos Leon Velarde (Co-PI) and Nicola Linton (Team member). Evaluation of a High Throughput CRISPR Sequence-Based Method for Identification of Multiple Salmonella Serovars in a Sample from Poultry Production Environments. Proposal submitted to Ontario Agri-Food Research Initiative Program (OMAFRA). December 2020 – present.

D.1.5 Additional Scientific Contributions

Official methods validated by AFL and approved by Microbiology Method Committee (MMC), Government of Canada.

1. MFLP-112 Detection of Listeria Species in a Variety of Environmental Surface Samples Using GENE-UP® Listeria spp. 2 (LIS 2) Method, October 2021.

2. MFLP-30 Detection of *Escherichia coli* O157:H7 in Select Foods using the BAX® System *E. coli* O157:H7 MP, November 2021.

D.1.6 Other

1. Melody Melzer 2021. The Canadian Phytopathological Society 2021 Photo Contest award (1st prize, Microscopic Plant Pathology category). 2021.

Figure D.1: Spore Tendrils of a Canker Causing Fungus (Phomopsis sp.) Growing from Smoketree

D.2 Highly Qualified Personnel (HQP) Training

AFL contributed to the training of six HQP in 2021/22.

1. Shu Chen served on graduate committee as a co-supervisor for MSc candidate Wesley Wilson (Department of Food Science, University of Guelph).
2. Carlos Leon-Velarde served as a project Advisor for MSc (FSQA) candidate Manika Singh (Department of Food Science, University of Guelph).
3. Carlos Leon-Velarde served as a project Advisor for MSc (FSQA) candidate Sukmanvir Kaur (Department of Food Science, University of Guelph).
4. Carlos Leon-Velarde served on graduate committee for PhD candidate Dharamdeo Singh (Department of Food Science, University of Guelph).
5. Saleema Saleh-Lakha served as a project Advisor (Co-supervisor) for MSc (FSQA) candidate Ana Lozano (Department of Food Science, University of Guelph).
6. Shu Chen/Nicola Linton provided orientation/training for fish species analysis of sushi samples by next generation sequencing for MSc candidate Sujani Rathnayake (Department of Integrative Biology, University of Guelph).