



DUPONT



DUPONT

## Energy, food, health: Soybean fund feeds new ideas for faculty, students

SOYBEANS AND THEIR UNTAPPED POTENTIAL FOR disease prevention, manufacturing and “green” technologies have sparked a bevy of development initiatives at the University of Guelph. There’s Soy 20/20, a collaboration between U of G, federal and provincial governments and the Ontario Soybean Growers to encourage research, production and commercialization of soy-based technologies. There’s a new communication partnership with OSG, designed to further enhance both public and industry understanding of this important oilseed. And there’s the success story of Project SOY (Soybean Opportunities for Youth), a competition that puts Guelph students in the driver’s seat in inventing new uses and marketing strategies for the versatile bean.

Now, another important initiative is starting to yield results — the Hannam Soybean Utilization Fund (HSUF). It’s helping to cultivate pioneering research at the University of Guelph and its affiliate colleges, to expand this unique crop’s many applications.

### New products, new strategies

HSUF was established in 2000 with a \$1-million endowment by First Line Seeds’ co-founder and OAC alumnus Peter Hannam and his family, to promote innovative medical, industrial and nutritive uses and marketing strategies for Ontario’s soybeans.

Soy’s status as a “miracle food” has made it a ripe target for nutritional product development from U of G food scientists, including iron supplements, value-added dairy products

and even time-release medical capsules. But researchers in other disciplines are also capitalizing on soy’s versatility. For example, animal scientists are taking a closer look at using soy protein as fish feed. Human biologists believe that soy components may help treat a common and lethal kidney disease. And soy-based biodegradable packaging material developed by Guelph engineers is set to hit grocery stores this year.

### A wide diversity of ideas

Reflecting on the fund’s first four years of existence, Hannam is impressed by the wide range of soy research catalyzed by HSUF funding.

“The faculty and students at Guelph have really risen to the challenge of creating new products and strategies for soybeans,” he says. “There’s such a wide diversity of ideas. I’m glad to have played a small role in stimulating interest in Ontario soybeans.”

University of Guelph vice-president (research) Alan Wildeman praises Hannam for recognizing that research partnerships between academia and industry are a major route to innovative new technologies.

“The Hannam Soybean Utilization Fund has an important role in the search for ways of diversifying the uses of soybeans,” says Wildeman. “There is an ever-greater need for discovering new ways of enhancing the value of this important crop, be it through new uses in food, manufacturing or health.”

---

**“The faculty and students at Guelph have really risen to the challenge of creating new products and strategies for soybeans.”**

— PETER HANNAM

# Soy for life

SOYBEANS ALREADY HAVE A REPUTATION AS A MULTI-purpose functional food. Now, in four HSUF-funded projects, University of Guelph researchers are taking soy's health benefits to the next level.

Prof. Bruce Holub and Dr. Diana Philbrick, Department of Human Biology and Nutritional Sciences, are studying potential therapeutic effects of soyasaponin B, a soybean component that may be helpful in treating polycystic kidney disease (PKD).

The disease causes cysts to develop on the kidney. It's the most common inheritable fatal disease in the world, affecting some 50,000 Canadians and 12.5 million others worldwide. There's no cure for PKD, but the researchers believe soyasaponin B can help treat patients for pain and associated complications.

"Right now, we can't eliminate the disease," says Philbrick, "but we hope to be able to lessen or eliminate discomfort for PKD patients by stopping the growth and development of these painful cysts."

In other health-related research, Prof. Yukio

Kakuda and former M.Sc. candidate Amy Proulx, Department of Food Science, are working to develop new iron supplements derived from soy. Soybean nodules are also a rich and economical source of heme iron, a form of the mineral that's easily absorbed by humans.

The researchers are targeting heme iron supplements for people in developing countries. The main source of heme iron is meat, but many people in these areas can't afford to keep food animals or buy meat. As a result, as much as one-third of the population suffers from iron deficiencies such as anemia.

"Soybean crops can be grown around the world, making them a potentially self-sustaining source of iron," says Kakuda. "That could help to alleviate iron deficiencies and conditions like anemia in areas where these problems run rampant."

And still in the nutrition realm, Food Science Profs. Milena Corredig and Douglas Dagleish are developing new methods of introducing soybean proteins into dairy foods such as enriched milk

and yoghurt. In this way, consumers could enjoy the health benefits of both milk and soy in one product.

When processed with other ingredients, heart-healthy soy proteins usually lower final product quality, especially in terms of texture and stability.

"Soybean crops can be grown around the world, making them a potentially self-sustaining source of iron."

— YUKIO KAKUDA

Corredig and Dagleish want to change that, by combining dairy and soy proteins using novel methods that will preserve the nutritional value of both components for the increasingly health-conscious market, while maintaining optimal texture and flavour in the new food products.

"Milk and soybean proteins both have some good qualities," says Corredig. "We want to put the



MARTIN SCHWALBE

two together, and give consumers the best of both worlds.”

From healthier food to better drug delivery, Food Science Profs. Peter Purslow and Massimo Marcone are using soy protein to produce food-grade biodegradable film and foam materials that break down slowly, for use in time-release, orally administered medications.

It’s a new strategy to deliver health products such as micronutrients and pharmaceuticals. For example, farmers could control parasites that reside in animal digestive tracts, using pathogen-fighting fungi held in soy protein capsules that are slowly released in the gut. Human applications may not be far off in the future, says Purslow.

“There are several exciting prospects where we could use these types of delivery methods,” he says. “Soy-based slow-release systems are an innovative product that I hope will have an impact on animal health.” He’s currently teaming up with veterinarians in Argentina to engineer a pill for cattle to fight parasites.



*above>>* Melts in your stomach, not in your hand: Profs. Peter Purslow (left) and Massimo Marcone are creating soy-based biodegradable capsules that slowly release medication to patients.

*left>>* Profs. Douglas Dagleish and Milena Corredig are combining soy proteins with dairy foods to “give consumers the best of both worlds.”



DUPONT

## Biodiesel: An energy source that’s full of beans

It’s CLEAN, RENEWABLE...AND HEADED FOR Canadian homes. The growing popularity of biodiesel — fuel derived from biological sources, such as plant oils and animal fats — as transportation fuel in North America and Europe has been turning heads for its low sulphur content and fewer pollution effects than normal diesel.

It’s caught the attention of Prof. Ralph Brown of the School of Engineering and Robert Peden of UPI, Inc. Now they’re leading a project to create soy-derived biodiesel for home heating.

Past research showed biodiesel releases lower amounts of harmful sulphur-bearing pollutants and fossil fuel-derived carbon to the atmosphere. Compared to traditional home furnace oils, says Brown, a soy biodiesel mix would make a significantly smaller impact on the environment. Consider the size of the Ontario furnace fuel market alone — it uses a whopping 1.3 billion litres of fuel every year.

Adds Peden: “Even with our proposed two

per cent mixture of soy biodiesel into current home heating fuels, that’s still millions of litres of fuel that’s renewable and cleaner-burning.”

The higher cost and relative obscurity of soybean-based biodiesel makes it a challenge to market. So, Allen Hills of Kemptville College and Dean Donaldson of the Ontario Ministry of Agriculture and Food are looking at soy biodiesel from marketing and practical perspectives, to find ways to increase its use across the province.

Because it’s more expensive to manufacture than traditional petroleum-based fuels, Hills and Donaldson believe biodiesel needs government initiatives to level the playing field.

“Application of emission standards, or government tax cuts to lower its retail cost, would make it more appealing, economically, for companies and individuals to use,” says Hills. “To facilitate consumer acceptance — and a cleaner environment — we need to champion the use of biodiesel.”

# Something to chew on

SOYBEAN APPLICATIONS HAVE BECOME SO VERSATILE that many forget it's an important foodstuff. But U of G researchers are back in the food court to create new food products from soy.

Food packaging will soon be as edible as its contents, thanks to Prof. Gauri Mittal and graduate student Eugene Mohareb, School of Engineering, who have developed a soy-based, food-grade packaging material.

Edible soy packaging, which will be on grocery store shelves within the year, can replace styrofoam packaging for leafy greens and meat products. Strawberry- and chocolate-flavoured soy packaging is also set to replace plastic cookie trays. A preliminary consumer survey has already shown great interest in this natural food packaging.

"Consumers are receptive to the product because it's good for the environment," says Mittal, "and because they recognize the health benefits of soy protein."

Further to consumers' interests, Prof. Peter Pauls, Department of Plant Agriculture won HSUF support to make soy products more palatable, by eliminating that "beany" taste some consumers find unappetizing.

The problem is that soybean oils' heart-healthy traits make them prone to oxidation, which is responsible for the undesirable taste. Pauls is trying to turn that around, using genetic techniques to reduce levels of the components that produce those "off" flavours.

"This research brings together traditional breeding and molecular biology to produce

Prof. Peter Pauls is examining new methods to eliminate the "beany" taste of soybeans, in order to widen their appeal in the consumer market.



soybeans with improved taste," says Pauls. He's collaborating with Drs. Vaino Poysa and Kangfu Yu of Agriculture and Agri-Food Canada, Prof. Istvan Rajcan of U of G's Department of Plant Agriculture and Prof. Gary Ablett of Ridgetown College.

Researchers are also looking at other species for new soybean markets. Prof. Dominique Bureau, Department of Animal and Poultry Science, is working on two initiatives that could see increased soybean use in fish feeds.

In the first, he and graduate students Hernan Ruiz and Nicola Cross are designing all plant-based feeds partly derived from soybean meal

— an inexpensive protein source — and oils for aquaculture operations. But fish can only take so much soy: the beans have a high carbohydrate fraction that's partially indigestible to many species. So in a second project, Bureau and graduate student Ayoleke Ogunkoya have added an enzyme to a diet to help further digest carbohydrates, reducing the manure waste from fish.

"Soybeans are about half the price of other protein sources," says Bureau, "and by improving their digestibility, we can create economical feeds that produce better fish and reduce water pollution."

## HSUF AWARDS 2000-2004

**Prof. Ralph Brown, School of Engineering and Robert Peden, UPI, Inc.**  
"Biofuel for home heating"

**Prof. Dominique Bureau, Department of Animal and Poultry Science**  
"Soybean-based all-plant fish feeds to produce grain-fed rainbow trout" and "Improving soybean utilization in aquaculture feeds"

**Profs. Douglas Dalglish and Milena Corredig, Department of Food Science**  
"How can soybean proteins be successfully introduced into dairy-based food?"

**Prof. Bruce Holub and Dr. Diana Philbrick, Department of Human Biology and Nutritional Sciences**  
"Use of soy products to treat autosomal dominant kidney disease"

**Allen Hills, Kemptville College and Dean Donaldson, Ontario Ministry of Agriculture and Food**  
"Marketing and using soy biodiesel in Ontario"

**Prof. Gauri Mittal, School of Engineering**  
"Biodegradable and edible soy-based packaging material for food products"

**Prof. Peter Pauls, Department of Plant Agriculture**

"Developing gene-based markers for soybean lines with improved flavour" and "Developing low-linolenic, lipoxygenase-free soybean lines for improved soymilk stability and flavour"

**Amy Proulx and Prof. Yukio Kakuda, Department of Food Science**  
"Iron bioavailability determination of soy root nodules"

**Profs. Peter Purslow and Massimo Marcone, Department of Food Science**  
"Biodegradable soy polymer delivery system for slow release of micronutrients and biologically active compounds"

*Focus on HSUF* is written by student participants in SPARK (Students Promoting Awareness of Research Knowledge), Office of Research, University Centre, Room 437, University of Guelph, Guelph, Ontario N1G 2W1 >> Phone: 519.824.4120 Ext. 58278 >> Fax: 519.821.5236 >> E-mail: info@research.uoguelph.ca >> Web site: www.uoguelph.ca/research  
Editor: Owen Roberts >> Editorial Co-ordinator: Murray Tong >> Editorial Assistance: Janice DeMoor >> Contributors: Sarah Brown, Clare Illingworth, Leslie Irons, Alison Schneider, Murray Tong, Cheryl Trueman >> Design and Layout: Jay Dart >> First Printing: April 2004