O-Week 2020 Special Lecture Series
9 September 2020
Topic: You can put on a coat but how do cold-blooded organisms survive
Presenter: Dr. Steffen Graether

WEBVTT

00:00:15.810 --> 00:00:19.140
corner of the undergraduate academic information center and just going to.

00:00:19.140 --> 00:00:22.350
oing to quickly introduce to you doctor steven greither and

00:00:22.350 --> 00:00:25.660
is associate professor in the Department of molecular.

00:00:25.660 --> 00:00:29.230
and cellular biology and his talk today.

00:00:29.230 --> 00:00:33.330
is you can put a card on a coat on.

00:00:33.330 --> 00:00:35.670
a coat, but how do you cold blooded?

00:00:35.730 --> 00:00:38.780
How do cold blooded organisms survive? Sorry.

00:00:38.780 --> 00:00:42.780
I've talked so much today. It's all mixed up anyways.

00:00:42.780 --> 00:00:45.820
I'm going to hand it over to doctor greater an he's going.

00:00:45.820 --> 00:00:46.850
to go from there.

00:00:49.000 --> 00:00:50.640
Thanks very much.

00:00:51.570 --> 00:00:54.580
I hope you guys I really do. Hope you guys are doing well.

00:00:54.580 --> 00:00:58.160
This is really a bit different for everyone I.

00:00:58.160 --> 00:01:01.640
just like you guys. I really wish we could actually be in the same room.

00:01:01.640 --> 00:01:04.820
to be honest. Right now I feel like I'm just talking.

00:01:04.820 --> 00:01:07.920
to my computer. I know there will have.

00:01:07.920 --> 00:01:10.980
some Q&A at the at the end. Hopefully happy to interact.

00:01:10.980 --> 00:01:12.450
with you guys. Talk to you guys.

00:01:13.800 --> 00:01:17.310
But for now I got my title here and.

00:01:17.310 --> 00:01:20.550
I'd like to do a lot is show this slide talk about.

00:01:20.550 --> 00:01:23.970
how do we survive the cold how do we as human survive

00:01:23.970 --> 00:01:27.050
ve the cold? Some of you from out West might recognize.

00:01:27.050 --> 00:01:30.610
this is a view of downtown Edmonton. This is where I did my.

00:01:30.610 --> 00:01:34.210
post doctoral fellowship. This is actually where I spent about 6.

00:01:34.210 --> 00:01:37.350
x years studying these anti freeze proteins. One of these things.

00:01:37.350 --> 00:01:40.370
I'm going to be talking about today and this view is actually.

00:01:40.370 --> 00:01:43.490
pretty close to where my apartment was and it.

00:01:43.490 --> 00:01:44.610
great at the time.

00:01:44.660 --> 00:01:47.750
Because down here you kind of see where I'm sort of.

00:01:47.750 --> 00:01:51.390
pointing and see there's this power station and this of course is.

00:01:51.390 --> 00:01:54.630
sort of the gashes plumes little clouds that were coming.

00:01:54.630 --> 00:01:57.900
out, and that actually use that to kind of guess.

00:01:57.900 --> 00:02:01.230
what the temperature might be outside. So in a day like this.

00:02:01.230 --> 00:02:04.610
based on the length of how long that cloud is.

00:02:04.610 --> 00:02:08.080

yeah I could tell us about minus 20. Give her takers.

00:02:08.080 --> 00:02:11.430
degree comma 5 degrees or so it was cold.

00:02:11.430 --> 00:02:14.770
and I like this slide because it shows exactly how do we.

00:02:14.770 --> 00:02:15.930
deal with the cold.

00:02:15.980 --> 00:02:19.230
For one, this power station here course generating.

00:02:19.230 --> 00:02:22.250
electricity. What to use? What to heat up for?

00:02:22.250 --> 00:02:25.330
example. In this case my apartment with electrical heat to.

00:02:25.330 --> 00:02:28.490
keep warm. We also have of course buildings.

00:02:28.490 --> 00:02:31.610
right? We stay inside. We don't spend a lot of time necessarily outside.

00:02:31.610 --> 00:02:34.670
When I spend the whole day outside, we keep the buildings as well protects.

00:02:34.670 --> 00:02:37.980
rom the elements, but now imagine.

00:02:37.980 --> 00:02:41.410
you're some little insects stuck on this tree outside, right?

00:02:41.410 --> 00:02:44.530
You don't have heating. You don't have housing you don't have.

00:02:44.530 --> 00:02:46.130
clothing on to keep you warm.

00:02:46.260 --> 00:02:49.370
How do you survive the cold? How do you deal with?

00:02:49.370 --> 00:02:52.510
hat and that's the kind of thing I want to talk about today sort of

00:02:52.510 --> 00:02:56.210
I just have one or two mechanisms. There's a lot of different ways that organisms.

00:02:56.210 --> 00:02:59.790
can go out and survive the cold, so.

00:02:59.790 --> 00:02:59.790

00:03:01.250 --> 00:03:04.990
Of course you guys are going to be in classes.

00:03:04.990 --> 00:03:08.000
and a lot of class is used for what we call clicker type.

00:03:08.000 --> 00:03:11.090
questions, and in this case I'm going to use one called Kahoot.

00:03:11.090 --> 00:03:14.330
Same idea of some of your profs might be using it so it.

00:03:14.330 --> 00:03:17.540
might be using something similar, but the idea is.

00:03:17.540 --> 00:03:19.800
I'm going to now switch over here.

00:03:21.380 --> 00:03:24.410
Through the browser window. I hope you can see the browser window the.

00:03:24.410 --> 00:03:27.750
idea is these are questions where I can interact with you so.

00:03:27.750 --> 00:03:31.070
I'm going to encourage you guys. You can see up here where I'm pointing.

00:03:31.070 --> 00:03:34.510
and see the website. Please type it in when you.

00:03:34.510 --> 00:03:37.790
get to this number. Here are sorry when you get that page.

00:03:37.790 --> 00:03:42.010
type in that number and then you can join. You have to add a nickname, OK?

00:03:42.010 --> 00:03:42.010

00:03:42.600 --> 00:03:44.780
So I'm hoping you guys can see that.

00:03:46.300 --> 00:03:48.030
Nobody is joining me yet.

00:03:50.980 --> 00:03:54.180
Actually share if you're able to unmute, can you tell me if you can see?

00:03:54.180 --> 00:03:57.330
a web page with oscillating colors that says kahoot?

00:03:57.330 --> 00:04:00.430
I can see it and we have about 90 attendees.

00:04:00.430 --> 00:04:03.550
on line right now. So OK, you should start to get.

00:04:03.550 --> 00:04:06.720
some. Yep, thank you for joining us.

00:04:06.720 --> 00:04:09.180
Yep, should also warn you guys you're trying.

00:04:09.740 --> 00:04:13.270
Certain, let's say, swear words inappropriate.

00:04:13.270 --> 00:04:16.520
words will get blocked out. Yeah, you can.

00:04:16.520 --> 00:04:20.300
use the poop emoji. Good to see some creativity there, OK?

00:04:20.300 --> 00:04:23.720
but seriously, nice user nickname. You don't have to use your own name.

00:04:23.720 --> 00:04:26.890
I'm going to wait about a minute or so. Let you guys go.

00:04:26.890 --> 00:04:29.960
ahead with and then we're going to actually start the actual.

00:04:29.960 --> 00:04:33.060
quiz. So they're going to be used. You going to be a question I will ask.

00:04:33.060 --> 00:04:36.340
and then I want you guys to answer what you think might be the correct.

00:04:36.340 --> 00:04:39.790
answer. Now the reason I like kahoot is, well, you can use personalized.

00:04:39.790 --> 00:04:42.650
es. Some of my students have a little bit of fun.

00:04:42.880 --> 00:04:46.310
Coming up with names and it's a bit of a game sort of a scoring.

00:04:46.310 --> 00:04:49.610
system, so what you can do is you.

00:04:49.610 --> 00:04:52.740
can sorry what you can do, but what happens is the faster that you answer.

00:04:52.740 --> 00:04:55.890
the more points that you get and we have a couple of questions as well.

00:04:55.890 --> 00:04:59.330
as the more points you accumulate. We'll see where you sort of rank.

00:04:59.330 --> 00:05:01.140

at the end of the session.

00:05:04.090 --> 00:05:07.340
So I'm going to go ahead. I know some of you still.

00:05:07.340 --> 00:05:10.350
joining us. Unfortunately, the Cuda currently have.

00:05:10.350 --> 00:05:10.350

00:05:11.040 --> 00:05:16.410
As a bit of a limit on the number of participants, I think normally it's 50.

00:05:17.230 --> 00:05:18.730
Instead, start now.

00:05:19.440 --> 00:05:21.380
First question is going to come up.

00:05:22.100 --> 00:05:23.390
In a couple of seconds.

00:05:25.070 --> 00:05:28.760
So how to cold blooded organisms survive the cold OK?

00:05:28.760 --> 00:05:28.760

00:05:29.500 --> 00:05:38.790

00:05:40.350 --> 00:05:43.460
And you can see this little countdown timer over here on.

00:05:43.460 --> 00:05:47.260
your left number. Of course number seconds left. You have to answer.

00:05:47.260 --> 00:05:47.260

00:05:49.080 --> 00:05:57.290

00:06:01.670 --> 00:06:07.290

00:06:08.140 --> 00:06:17.290

00:06:18.040 --> 00:06:21.340
We're counting down again. I say your.

00:06:21.340 --> 00:06:24.930
instructors might have something different when log size very similar for.

00:06:24.930 --> 00:06:28.090
sort of answers, ABCDE give you chance to sort.

00:06:28.090 --> 00:06:31.390
of think about things. OK, let's see a nice.

00:06:31.390 --> 00:06:32.300
breakdown.

00:06:33.380 --> 00:06:36.890
And I'm happy to see a good 49%.

00:06:36.890 --> 00:06:40.240
or sorry. Not 464. Nine people got the correct answer.

00:06:40.240 --> 00:06:42.080
All the above. OK so.

00:06:45.610 --> 00:06:49.490
And here we have the top scores. Congratulations to H RW.

00:06:49.490 --> 00:06:52.620
again, my friend Ben first person.

00:06:52.620 --> 00:06:54.670
to break the ice during the group. Great job.

00:06:55.500 --> 00:06:59.380
So we'll get next. Yes, we do have a few other questions, but now.

00:07:00.320 --> 00:07:03.120
Let's go back to this. So the answer is all of the above.

00:07:04.040 --> 00:07:06.020
So hopefully, what did we learn?

00:07:07.290 --> 00:07:10.400
You can see every hopefully can remember from the question.

00:07:10.400 --> 00:07:13.640
I had two answers that seem almost contradictory right one.

00:07:13.640 --> 00:07:16.690
said well, they're going to prevent freezing that makes.

00:07:16.690 --> 00:07:19.990
sense, right? We'll talk about that, but there are some.

00:07:19.990 --> 00:07:23.430
organisms that survive the cold by inducing.

00:07:23.430 --> 00:07:26.600
inoculating free to causing freezing to happen.

00:07:26.600 --> 00:07:29.740
will hear a bit about those later on as.

00:07:29.740 --> 00:07:32.780
well. So the idea is, I guess the.

00:07:32.780 --> 00:07:35.910
basic idea is it says that in nature there's a lot.

00:07:35.910 --> 00:07:37.920
ere's a lot of different ways to survive the cold.

00:07:38.160 --> 00:07:41.280
And that's something for those of you in biological sciences. Matter what?

00:07:41.280 --> 00:07:44.470
the discipline. Hope there's something going to learn over and over again, I mean.

00:07:44.470 --> 00:07:47.940
n I'll be honest I mean I've been out this way too long than I care to admit

00:07:47.940 --> 00:07:51.080
t an it just amazes me every time you learn something new about.

00:07:51.080 --> 00:07:54.090
some organism that's come up with some different way to survive.

00:07:54.090 --> 00:07:54.090

00:07:55.490 --> 00:07:58.690
Now the ones we're going to focus on a bit among the most.

00:07:58.690 --> 00:08:02.120
for this talk are these things called antifreeze.

00:08:02.120 --> 00:08:05.260
FPS manure name that.

00:08:05.260 --> 00:08:08.420
people are starting to use ice binding proteins or ICP?

00:08:08.420 --> 00:08:11.860
Similar kind of thing, and the reason is.

00:08:11.860 --> 00:08:14.950
why studying RC? Not the reason. But the question is why do we want?

00:08:14.950 --> 00:08:18.660
to study? It's sort of the classical.

00:08:18.660 --> 00:08:21.780
cyantific most scientific way, but maybe, but thinking about.

00:08:21.780 --> 00:08:24.920

it right, and that's my first point here, ice as a.

00:08:24.920 --> 00:08:26.960
model of the protein water interaction.

00:08:27.220 --> 00:08:30.530
I'm sure you guys have learned over and over again throughout your years.

00:08:30.530 --> 00:08:33.550
in school, right water is important for life. It is. I'm not.

00:08:33.550 --> 00:08:36.650
to realize it. Percent of the body made up of water is really.

00:08:36.650 --> 00:08:39.820
high and so on. I mean, water is just incredibly.

00:08:39.820 --> 00:08:42.870
important for us, so that's one of the things I'm.

00:08:42.870 --> 00:08:46.590
interested in, like understanding how to proteins, work, water.

00:08:46.590 --> 00:08:50.150
so important. Why is water important? Why do we need water?

00:08:50.150 --> 00:08:53.650
What is it doing with proteins and ice? Can kind of serve as a model?

00:08:53.650 --> 00:08:53.650

00:08:55.010 --> 00:08:58.460
Now another one and I won't get into it today, but believe it or not.

00:08:58.460 --> 00:09:02.060
there are several medical and bio technical logical.

00:09:02.060 --> 00:09:05.130
by a technical applications. Now the big one that you.

00:09:05.130 --> 00:09:08.330
might think of right away is something like.

00:09:08.330 --> 00:09:11.510
proteins. Things like storing tissue storing.

00:09:11.510 --> 00:09:14.650
blood, right people have looked a bit at and there's not a lot.

00:09:14.650 --> 00:09:17.840
of success with that yet. Storing let's.

00:09:17.840 --> 00:09:21.130
say, high value pharmaceuticals right again makes sense.

00:09:21.130 --> 00:09:24.630
You want to prevent freezing? You want to be able to store something cold, 'cause cold?

00:09:27.120 --> 00:09:30.310
But the same time, you don't want that cold to damage something, right?

00:09:30.310 --> 00:09:33.650
Thinking about like freezing, causing freezer burn on stored?

00:09:33.650 --> 00:09:36.390
food stored in the fridge, and the freezer.

00:09:37.040 --> 00:09:40.140
There's also one interesting medical application, it.

00:09:40.140 --> 00:09:43.380
was used a little bit, but it's going away and that is for treating.

00:09:43.380 --> 00:09:47.510
tumors, and they're actually a true that rumors with.

00:09:47.510 --> 00:09:50.620
any free subscriptions now quickly I won't get.

00:09:50.620 --> 00:09:53.640
into much into it, but one of the things that happens is people like.

00:09:53.640 --> 00:09:56.900
to put cold fingers on tumors. That kind of kill the tumor.

00:09:56.900 --> 00:10:00.040
cells. They've done that in the past. Sort of knows cryo treatment.

00:10:00.040 --> 00:10:03.120
and you might think. But if you want to freeze the tumor, why would you?

00:10:03.120 --> 00:10:07.300
add an antifreeze protein? Well, the reason is that.

00:10:07.300 --> 00:10:07.300

00:10:07.360 --> 00:10:10.430
Proteins, once you exceed their ability right, they.

00:10:10.430 --> 00:10:13.650
don't freeze, prevent freezing forever. They have a certain temperature range.

00:10:13.650 --> 00:10:16.850
It will look at in a little bit of a certain temperature range over which.

00:10:16.850 --> 00:10:20.190
they prevent freezing, but then you see that, and when you see.

00:10:20.190 --> 00:10:23.210
tempted when you go over that temperature, ice actually.

00:10:23.210 --> 00:10:26.370
grows very rapidly and that very rapid price growth is what?

00:10:26.370 --> 00:10:28.800
people think is help destroy tumor.

00:10:29.660 --> 00:10:30.220
Now.

00:10:31.810 --> 00:10:34.740
We go back to antifreeze proteins.

00:10:35.430 --> 00:10:36.620
So a second.

00:10:37.590 --> 00:10:38.860
Good question.

00:10:40.170 --> 00:10:43.760
So another question come up, can you separate freezing?

00:10:43.760 --> 00:10:45.410
and melting points?

00:10:46.830 --> 00:10:50.100
OK, can we do that? Can we take well?

00:10:50.100 --> 00:10:53.360
have something. Let's say I straight we freeze. It freezes certain temperature.

00:10:53.360 --> 00:10:56.580
melted certain temperature. Can we actually separate those two?

00:11:02.460 --> 00:11:09.370

00:11:09.690 --> 00:11:12.830
Not sure how wide my camera field is, but I've got.

00:11:12.830 --> 00:11:15.550
my cat here and it's decided to sit in my chair.

00:11:22.160 --> 00:11:25.180
Here the occasional meow. OK, it's not me, it's the.

00:11:25.180 --> 00:11:28.240
cat over here and they only see your screen share.

00:11:28.240 --> 00:11:31.290
right now. So OK, so the cats safe.

00:11:33.750 --> 00:11:35.690

OK, couple of seconds left.

00:11:41.490 --> 00:11:45.720

00:11:45.740 --> 00:11:48.980
OK, good so it's hard for me to fully guys large numbers.

00:11:48.980 --> 00:11:52.240
if you said yes, I'm going to guess you're going to go on the basis.

00:11:52.240 --> 00:11:54.340
that you asked the question so.

00:11:55.170 --> 00:11:56.570
Something going on here?

00:11:58.080 --> 00:12:01.330
So we've got some people still keeping.

00:12:01.330 --> 00:12:01.920
up good.

00:12:02.790 --> 00:12:03.250
Now.

00:12:06.140 --> 00:12:07.470
The answer is yes.

00:12:08.130 --> 00:12:11.440
OK, but still think about it.

00:12:11.440 --> 00:12:14.680
OK, that's a bit weird. Ice more.

00:12:14.680 --> 00:12:18.120
less or water slash ice more or less, it's going to freeze.

00:12:18.120 --> 00:12:21.260
and melt at the same temperatures. There's very little difference between through.

00:12:21.260 --> 00:12:23.030
sexually their equivalent.

00:12:24.270 --> 00:12:27.990
And just to illustrate that I've this sort of Schematic view here.

00:12:27.990 --> 00:12:31.190
and really what this?

00:12:31.190 --> 00:12:34.230
graph is talking about is you've got this.

00:12:34.230 --> 00:12:37.340
three different lines will get some intern, and you can kind.

00:12:37.340 --> 00:12:40.710
of think of the Y axis sort of as.

00:12:40.710 --> 00:12:43.990
temperature and the X axis.

00:12:43.990 --> 00:12:47.090
sort of his time. OK, it's not quite like that's a.

00:12:47.090 --> 00:12:50.110
little bit more involved, so what I'm doing here is.

00:12:50.110 --> 00:12:53.830
if we take pure water, OK, we start here.

00:12:53.830 --> 00:12:56.840
We're saying overtime we're adding some heat in.

00:12:56.840 --> 00:12:56.840

00:12:57.210 --> 00:13:00.220
Right, we're decreasing temperature that ice.

00:13:00.220 --> 00:13:03.440
you get of course to zero degrees. What's going to happen?

00:13:03.440 --> 00:13:06.460
is it's going to start to melt, and if that temperature is.

00:13:06.460 --> 00:13:09.540
not changing, essentially that melting.

00:13:09.540 --> 00:13:13.100
it's going to be isothermal. The same temperature, right?

00:13:13.100 --> 00:13:16.130
cause breaking bonds takes energy, so the temperature not going to.

00:13:16.130 --> 00:13:19.270
change, but at some point? Sorry we're going the wrong way, we're freezing.

00:13:19.270 --> 00:13:23.180
is we're going down, so we've got liquid water here, it's freezing.

00:13:23.180 --> 00:13:26.520
at some point, freezing, freezing. At some point it becomes completely.

00:13:26.520 --> 00:13:29.680
ice. And then when it's completely ice ice block itself as we cool.

00:13:29.680 --> 00:13:30.710
the temperature.

00:13:30.920 --> 00:13:31.980
Will get cooler cooler.

00:13:32.590 --> 00:13:35.820
Water plus salt. OK you guys.

00:13:35.820 --> 00:13:39.300
my windows over here, that's fine pointing to my left soon enough.

00:13:39.300 --> 00:13:42.580
we'll see how the roads will see ice and snow. What happens we put.

00:13:42.580 --> 00:13:42.580

00:13:43.730 --> 00:13:46.960
A salt on it doesn't freeze right away, right?

00:13:46.960 --> 00:13:50.180
Salt depresses the freezing point, but at some point that.

00:13:50.180 --> 00:13:53.660
ice, salt mix water, salt mix looking to become ice.

00:13:53.660 --> 00:13:56.880
and again same thing. Now this is the weird one, the last one in red.

00:13:56.880 --> 00:14:00.080
So if we have an antifreeze protein.

00:14:00.080 --> 00:14:03.120
added in solution we added it to some water.

00:14:03.120 --> 00:14:06.460
What's going to happen is we're going to decrease the temperature, yeah?

00:14:06.460 --> 00:14:09.840
it's not going to freeze at zero. OK, obviously.

00:14:09.840 --> 00:14:12.980
the antifreeze protein it depresses, it decreases the.

00:14:12.980 --> 00:14:13.850
freezing point.

00:14:14.030 --> 00:14:17.100
But at some point, like I said before, it's.

00:14:17.100 --> 00:14:20.240
going to reach it limit. So solutions with AFP they will.

00:14:20.240 --> 00:14:23.820
freeze and that temperature depends on the antifreeze protein itself.

00:14:23.820 --> 00:14:26.860

and then it'll go down in temperature that.

00:14:26.860 --> 00:14:30.390
I CFP mix. Now here's the part.

00:14:30.390 --> 00:14:33.780
Here's the payoff. This is the interesting part as we take.

00:14:33.780 --> 00:14:37.590
a nice AFP mixture and we raise the temperature.

00:14:37.590 --> 00:14:40.740
It does not thaw at the freezing.

00:14:40.740 --> 00:14:42.350
point. It actually gets too.

00:14:43.020 --> 00:14:46.730
a little bit should actually be a little bit above zero now um

00:14:46.730 --> 00:14:48.640
hen only then.

00:14:49.490 --> 00:14:52.820
Do you start to melt so this gap here? That's what I'm talking.

00:14:52.820 --> 00:14:56.110
bout a difference between the freezing point and the melting point.

00:14:56.110 --> 00:14:59.290
And we call that thermal hysteresis hysteresis.

00:14:59.290 --> 00:15:02.790
cause you separated two properties. The properties are different depending.

00:15:02.790 --> 00:15:06.220
on this case, which temperature coming from whether high or low.

00:15:06.220 --> 00:15:06.220

00:15:07.060 --> 00:15:10.430
And that whoops, there we go.

00:15:10.430 --> 00:15:10.430

00:15:12.010 --> 00:15:16.010
And that difference is a measurement of AFP activity so.

00:15:16.010 --> 00:15:19.200
some proteins, things like those implants.

00:15:19.200 --> 00:15:22.560
or actually very weak and I won't have time to talk about it today.

00:15:22.560 --> 00:15:25.940
it today but their activities actually very weak and there's a reason why

00:15:25.940 --> 00:15:29.040
ings insects have very high.

00:15:29.040 --> 00:15:32.380
activity. Now high is at least for purified protein.

00:15:32.380 --> 00:15:35.720
We're sort of saying 56 degrees. You can depress the temperature.

00:15:35.720 --> 00:15:38.880
maybe minus 7 - 8, and then I still grow.

00:15:38.880 --> 00:15:42.060
fish again. In another example, these are all.

00:15:42.060 --> 00:15:43.920
sort of cold blooded organisms.

00:15:44.500 --> 00:15:47.630
Hasn't rejected the moderate sort of minus 1 degree.

00:15:47.630 --> 00:15:50.520
so it's not a lot, but it's enough to provide protection.

00:15:51.310 --> 00:15:54.540
and the next slide all I want to show you guys this is equipment

00:15:54.540 --> 00:15:57.880
t that we use this stuff up front. Sorry this is a picture.

00:15:57.880 --> 00:16:00.980
of my lab. You can see it's messy I.

00:16:00.980 --> 00:16:04.200
kind of like that. 'cause it means my students are doing stuff but.

00:16:04.200 --> 00:16:07.320
up front here we have a microscope. This is called the Nano.

00:16:07.320 --> 00:16:10.400
Immolator's mom. It are really it's just.

00:16:10.400 --> 00:16:13.740
fancy term for very fine temperature controlling group control.

00:16:13.740 --> 00:16:17.220
ed temperature very accurately at .1 degrees. You can see this block.

00:16:17.220 --> 00:16:20.360
here. That's where the actual measurement goes. We do it under.

00:16:20.360 --> 00:16:22.620
microscope who's very small volumes.

00:16:22.680 --> 00:16:25.690
It's called Nano leader because it literally uses like about 100.

00:16:25.690 --> 00:16:28.930
hundred nanoliters, so 10 to the minus nine leaders.

00:16:28.930 --> 00:16:32.090
very small amount of liquid and this is just a bath here.

00:16:32.090 --> 00:16:35.190
nt temperature of the liquid just

00:16:35.190 --> 00:16:38.650
he liquid just sort of water antifreeze mix not any fish protein but actual.

00:16:38.650 --> 00:16:41.810
ethylene glycol antifreeze down about 2 degrees.

00:16:41.810 --> 00:16:45.010
right? And this guy here brings the temperature down lower to like.

00:16:45.010 --> 00:16:48.030
minus 20 or so. Now how do we measure?

00:16:48.030 --> 00:16:50.030
activity? What do we actually do?

00:16:51.520 --> 00:16:55.080
So here's an example of what.

00:16:55.080 --> 00:16:58.380
we see under that microscope. So now we're looking at the microscope.

00:16:58.380 --> 00:16:58.380

00:16:59.280 --> 00:17:02.310
So this here this represents sees negative control.

00:17:02.310 --> 00:17:05.590
C minus that control that's water right

00:17:05.590 --> 00:17:08.880
ght? So if you have a tiny disk water and put it inside, the oil drops.

00:17:08.880 --> 00:17:12.350
we can watch these crystals grow and what you would see is just a small little.

00:17:12.350 --> 00:17:15.370
circle. As soon as you hit zero degrees, boom of course.

00:17:15.370 --> 00:17:19.250

t's going to start growing right. Water kind of freeze at 0.

00:17:19.250 --> 00:17:19.250

00:17:20.660 --> 00:17:23.690
And these here are just two different examples of.

00:17:23.690 --> 00:17:27.140
antifreeze proteins. It's a little hard to see here the pictures.

00:17:27.140 --> 00:17:30.580
They are quite magnified, but some of the antifreeze.

00:17:30.580 --> 00:17:33.590
ey form these what we call bipyramidal crystals.

00:17:33.590 --> 00:17:36.640
So imagine this sort of pyramid on top coming together and.

00:17:36.640 --> 00:17:39.900
another one on the bottom coming together. So that's a sign.

00:17:39.900 --> 00:17:43.420
of the fact that ice is not growing like this disk, but this beautiful.

00:17:43.420 --> 00:17:46.650
little crystal. Now that these proteins have is antifreeze.

00:17:46.650 --> 00:17:49.740
protein activity there binding to the surface.

00:17:49.740 --> 00:17:49.740

00:17:51.690 --> 00:17:54.800
So I just want to talk a little bit about the mechanism, just to give you an idea.

00:17:54.800 --> 00:17:57.830
of what sort of things we're confident about what's happening.

00:17:57.830 --> 00:18:01.260
and how these things basically kind of work.

00:18:01.260 --> 00:18:01.260

00:18:03.870 --> 00:18:07.020
so on your left here on the screen this is meant

00:18:07.020 --> 00:18:10.140
t to show the ice crystal here and.

00:18:10.140 --> 00:18:13.560
I score some macromolecular view, not an atomic view.

00:18:13.560 --> 00:18:16.620
And what I want you to get out of this figure here is the idea.

00:18:16.620 --> 00:18:19.660
that ice actually has different faces, right? I.

00:18:19.660 --> 00:18:22.830
pports is a crystal has different facets and

00:18:22.830 --> 00:18:26.370
and these faces the two big ones are the prism face.

00:18:26.370 --> 00:18:30.020
and you can see there's a total of 6 prism faces around.

00:18:30.020 --> 00:18:30.020

00:18:31.780 --> 00:18:34.840
So we end up Basil plane, which would be the top here, the very top.

00:18:34.840 --> 00:18:37.970
and also the bottom the ice crystals resting.

00:18:37.970 --> 00:18:41.030
the sort of square plane it's just meant

00:18:41.030 --> 00:18:44.690
ant to tell you that ice crystals have these different faces an.

00:18:44.690 --> 00:18:47.730
antifreeze, proteins, different antifreeze proteins bind to these.

00:18:47.730 --> 00:18:51.450
different faces and we actually think how they find these faces.

00:18:51.450 --> 00:18:54.950
is a measure of how effective they.

00:18:54.950 --> 00:18:58.010
are and on the right the actual inhibition.

00:18:58.010 --> 00:19:01.320
So again very schematic view. And this top here.

00:19:01.320 --> 00:19:01.870
is meant to be.

00:19:01.970 --> 00:19:05.100
I surface is growing and you can see that isis growing sort of

00:19:05.100 --> 00:19:06.290
this curve front.

00:19:08.170 --> 00:19:11.460
Alright, so over here there's nothing shown, but that's where sort of liquid water.

00:19:11.460 --> 00:19:14.560
would be that could be added to the front and how.

00:19:14.560 --> 00:19:17.860
we think proteins work as you see these little.

00:19:17.860 --> 00:19:21.300
circles here, right? That guy right there is 1 circle amigo.

00:19:21.300 --> 00:19:24.360
There's another one. There's a third one down here, so that's.

00:19:24.360 --> 00:19:27.760
meant to show schematically the antifreeze protein bound.

00:19:27.760 --> 00:19:30.880
to the surface. That's where it happens to be located and.

00:19:30.880 --> 00:19:34.360
we call a sort of the mattress Button Model 'cause The Dimension 3D.

00:19:34.360 --> 00:19:37.510
surface. If it was a surface mattress, you can see it. Sometimes they have.

00:19:37.510 --> 00:19:38.920
those buttons that push down.

00:19:39.160 --> 00:19:43.160
And it's because the protein binds to the spots.

00:19:43.160 --> 00:19:46.310
have to cover the complete service is not like what we call crystal.

00:19:46.310 --> 00:19:49.970
poison. It's not like it covers the entire service ice, but just combined.

00:19:49.970 --> 00:19:51.330
little bit spaced apart.

00:19:52.430 --> 00:19:55.530
And then what happens? I starts to grow as this curve front.

00:19:55.530 --> 00:19:56.860
right? You see that here.

00:19:57.640 --> 00:20:01.000
But the fact of the interface proteins are found here prevents.

00:20:01.000 --> 00:20:04.700
that growth from going on. It sort of stops that growth.

00:20:04.700 --> 00:20:07.830

from continuing, at least until you get until low enough temperature which.

00:20:07.830 --> 00:20:10.990
using overcome effectively FP. So it reaches some kind.

00:20:10.990 --> 00:20:14.210
of equilibrium here and then it stops, right? This is a growing.

00:20:14.210 --> 00:20:14.860
ice from.

00:20:16.470 --> 00:20:20.180
Now this next page is meant to show you and if you get anything.

00:20:20.180 --> 00:20:23.370
from my talk, is anything you really really remember it's.

00:20:23.370 --> 00:20:26.850
actually this part here, right? Because a lot of times.

00:20:26.850 --> 00:20:30.040
like I'm a biochemist. That's my main thing by proteins.

00:20:30.040 --> 00:20:33.150
Understanding of proteins work and we have these models in our head.

00:20:33.150 --> 00:20:36.340
and it's good to have these models, but we think of ice, right?

00:20:36.340 --> 00:20:40.400
We think of ice and just think about it's this ice crystal, right? So it's hard.

00:20:40.400 --> 00:20:42.300
defined thing.

00:20:42.970 --> 00:20:46.120
And reality is, it's a lot more fine than.

00:20:46.120 --> 00:20:49.180
that. So over here on your right you can see.

00:20:49.180 --> 00:20:52.240
the ice crystal so these little circles are represent meant to represent.

00:20:52.240 --> 00:20:55.260
just the auction atoms. I'm not showing the hydrogen atoms of.

00:20:55.260 --> 00:20:58.420
the water and you can see this is very regular.

00:20:58.420 --> 00:21:01.800
hexagonal lattice, right? You stare at you can kind of see what I'm.

00:21:01.800 --> 00:21:05.380
kind of pointing out here. There's one hexagon. There's multiple hexagons here.

00:21:05.380 --> 00:21:05.380

00:21:06.590 --> 00:21:10.000
And then over here on your left. Or sorry to say in the middle.

00:21:10.000 --> 00:21:13.520
we have what's called oops. There we go.

00:21:13.520 --> 00:21:16.620
Now what we call bulk water rights?

00:21:16.620 --> 00:21:19.720
water molecules with the kind of loose or Mr not.

00:21:19.720 --> 00:21:23.060
any particular orientation. They're just of course diffusing moving around.

00:21:23.060 --> 00:21:26.130
that point. I really want you guys to think about.

00:21:26.130 --> 00:21:29.220
really hopefully remember this is sluggish.

00:21:29.220 --> 00:21:32.390
water, right? This interface between ice.

00:21:32.390 --> 00:21:35.560
and bulk water. It's not like the sudden like hard.

00:21:35.560 --> 00:21:37.260
edge is not like the edge of a wall.

00:21:37.420 --> 00:21:40.030
There's this transition between the two.

00:21:41.160 --> 00:21:44.310
And I think right with this There's lots of ideas on how many.

00:21:44.310 --> 00:21:47.320
fish, proteins work and one of them, kind of.

00:21:47.320 --> 00:21:50.430
his idea of sort of sluggish water that maybe this is what's.

00:21:50.430 --> 00:21:53.510
important to think about ice and stuff, but really need to.

00:21:53.510 --> 00:21:56.530
think about what the sluggish water looks like this sort.

00:21:56.530 --> 00:21:59.600
of ice, like water over here we have a protein. That's an example.

00:21:59.600 --> 00:22:03.290
f antifreeze protein. We show a lot of proteins.

00:22:03.290 --> 00:22:06.670
in the sort of ribbon model is very simple.

00:22:06.670 --> 00:22:10.070
stylistic, not simple. It's very complicated.

00:22:10.070 --> 00:22:10.950
figure, but.

00:22:11.140 --> 00:22:14.870
In terms of considering, all atoms is much simpler representation.

00:22:14.870 --> 00:22:15.350
of it.

00:22:16.620 --> 00:22:20.170
And if two also has some water around it right? It's another thing.

00:22:20.170 --> 00:22:23.310
it was think about. Yeah, there's a protein. We show these figure here.

00:22:23.310 --> 00:22:27.110
because most remembered mostly proteins also surrounded by water.

00:22:27.110 --> 00:22:27.110

00:22:29.050 --> 00:22:29.530
Now.

00:22:30.370 --> 00:22:34.370
That's an example. There is a protein from.

00:22:34.370 --> 00:22:37.590
fish. It's called Eelpout, the protein.

00:22:37.590 --> 00:22:41.070
I worked a bit on that else worked at another one from.

00:22:41.070 --> 00:22:41.980
insect.

00:22:42.680 --> 00:22:44.370
And here you can kind of see.

00:22:45.290 --> 00:22:48.370
If you kind of got let's go back for a second, you can see even.

00:22:48.370 --> 00:22:51.620
without knowing anything else about proteins, hopefully can see their very different.

00:22:51.620 --> 00:22:54.680

shapes and a big thing in biochemistry.

00:22:54.680 --> 00:22:57.960
and protein biochemistry. Say proteins with similar structures.

00:22:57.960 --> 00:23:00.970
Proteins with similar shapes have similar functions.

00:23:00.970 --> 00:23:04.000
and the antifreeze protein is not the only example, but it's.

00:23:04.000 --> 00:23:07.100
an extreme example where we have all these different protein.

00:23:07.100 --> 00:23:10.360
folds. All these different proteins shapes, but they have.

00:23:10.360 --> 00:23:13.400
essentially the same structure so.

00:23:13.400 --> 00:23:16.720
that's also really interesting from an evolutionary point of view, why do?

00:23:16.720 --> 00:23:17.610
we have?

00:23:17.660 --> 00:23:20.750
All this evolution occurring and different points.

00:23:20.750 --> 00:23:24.670
and Fish and plants in yeast.

00:23:24.670 --> 00:23:27.890
and see diatoms and so on, and they all.

00:23:27.890 --> 00:23:31.170
have kind of different protein structures have different.

00:23:31.170 --> 00:23:33.030
answers to the same problem.

00:23:34.990 --> 00:23:38.210
The other thing I want to show you here is that just in red I.

00:23:38.210 --> 00:23:41.430
sort of recall I briefly mentioned how insect proteins.

00:23:41.430 --> 00:23:44.740
are very good antifreeze proteins and we think part of.

00:23:44.740 --> 00:23:48.030
the reason is what's shown here in red. So this here.

00:23:48.030 --> 00:23:51.220
The red shows the actual residues residues.

00:23:51.220 --> 00:23:54.500
being the parser protein. Individual immuno acids that.

00:23:54.500 --> 00:23:57.530
bind to ice and we could see that from an insect.

00:23:57.530 --> 00:24:00.820
AFP there's a lot of. There's a whole bunch of maroon we think.

00:24:00.820 --> 00:24:04.560
that sort of number of them gives a much better interaction.

00:24:04.560 --> 00:24:04.560

00:24:05.690 --> 00:24:06.250
Now.

00:24:07.400 --> 00:24:11.130
So I want to briefly talk about how do we determine protein structures?

00:24:11.130 --> 00:24:11.130

00:24:12.000 --> 00:24:15.250
And it's just a view just showing you this. The NMR facility.

00:24:15.250 --> 00:24:18.480
university of University of Guelph, its nuclear magnetic resonance.

00:24:18.480 --> 00:24:21.670
So that's a technique where we used.

00:24:21.670 --> 00:24:25.110
nuclear information. I'm not talking nuclear in the radioactive.

00:24:25.110 --> 00:24:28.250
sense. These are stable isotopes. Is nuclear in terms.

00:24:28.250 --> 00:24:31.940
of nucleus and we could actually probe.

00:24:31.940 --> 00:24:35.060
these proteins and see what their structure is. I mean just.

00:24:35.060 --> 00:24:38.890
think about that we can have we have the ability.

00:24:38.890 --> 00:24:41.950
to look at proteins at the atomic level we.

00:24:41.950 --> 00:24:42.330
can get.

00:24:42.380 --> 00:24:46.270
Information about individual atoms and proteins.

00:24:46.270 --> 00:24:50.270
right? It's something I've been working with now. I guess yeah, it's 25.

00:24:50.270 --> 00:24:53.290
now and just the idea still always really.

00:24:53.290 --> 00:24:56.870
actually tense, giving goosebumps and the idea that atoms are.

00:24:56.870 --> 00:25:00.150
not just abstract concepts concepts actually.

00:25:00.150 --> 00:25:03.410
look at them individually. Also, it's going to point out we have.

00:25:03.410 --> 00:25:06.430
two different magnets. There are different field strengths they.

00:25:06.430 --> 00:25:09.480
have different magnetic field intensities.

00:25:09.480 --> 00:25:12.650
This one is the 800, so it's the 600.

00:25:12.650 --> 00:25:12.650

00:25:13.890 --> 00:25:16.990
The numbers just represent sort of strength, but you can see that the change I mean.

00:25:16.990 --> 00:25:20.460
we're only going up 200 units if you will, but.

00:25:20.460 --> 00:25:23.600
it always requires a much bigger magnet, and nowadays there's talk.

00:25:23.600 --> 00:25:26.910
about 1.2 GHZ and.

00:25:26.910 --> 00:25:28.210
it's just.

00:25:29.010 --> 00:25:32.050
The going up in magnetic field strength just.

00:25:32.050 --> 00:25:33.650
gives you so much more information.

00:25:35.780 --> 00:25:36.860
So.

00:25:38.270 --> 00:25:39.790

Another quick question.

00:25:40.880 --> 00:25:42.220
Let's switch over.

00:25:43.210 --> 00:25:46.250
And I will tell you question before you see it and it's.

00:25:46.250 --> 00:25:48.810
to do with the NMR magnet, so NMR.

00:25:49.970 --> 00:25:52.980
The magnets in there are extremely high field.

00:25:52.980 --> 00:25:56.580
They are superconducting magnets.

00:25:56.580 --> 00:25:59.770
o superconducting materials

00:25:59.770 --> 00:26:03.440
at least in large scale we're still talking bout very low temperatures

00:26:03.440 --> 00:26:05.250
ures. So the question I have for you.

00:26:07.840 --> 00:26:10.970
It's talking about liquid helium. That's what's inside.

00:26:10.970 --> 00:26:14.190
these magnets. What's the temperature? Think inside the magnet.

00:26:14.190 --> 00:26:14.190

00:26:15.030 --> 00:26:17.180
Knowing that the insight is liquid helium.

00:26:20.000 --> 00:26:27.210

00:26:27.930 --> 00:26:37.210

00:26:40.140 --> 00:26:47.210

00:26:47.410 --> 00:26:57.210

00:26:57.210 --> 00:27:07.210

00:27:14.990 --> 00:27:16.240
So.

00:27:16.870 --> 00:27:20.130
Interesting, we have almost even split.

00:27:20.130 --> 00:27:20.130

00:27:21.850 --> 00:27:24.980
Between 4.2 and 2.2.

00:27:24.980 --> 00:27:25.640
kelvins.

00:27:26.340 --> 00:27:29.500
And it's a little bit tricky, because those of you said.

00:27:29.500 --> 00:27:29.500

00:27:30.300 --> 00:27:31.800
4.2 Kelvin's

00:27:32.720 --> 00:27:35.650
are partially correct. The temperature of liquid helium.

00:27:36.450 --> 00:27:39.760
is around 4.2 kelvins but these magnets actually

00:27:39.760 --> 00:27:43.540
r than that. OK, we'll just take a quick look.

00:27:44.640 --> 00:27:45.920
The standings.

00:27:48.320 --> 00:27:51.550
I get the feeling a chart WC my talk before.

00:27:51.550 --> 00:27:52.570
really good job.

00:27:55.010 --> 00:27:55.600
OK.

00:27:57.370 --> 00:28:01.060
And this is the point out that yes, we can actually go between the template.

00:28:01.870 --> 00:28:05.220
Standard atmospheric temperature of liquid helium so they do something called.

00:28:05.220 --> 00:28:08.300
pumping gas, so there's a little bit of vacuum done inside.

00:28:08.300 --> 00:28:11.340
of the magnet. Actually lower that temperature.

00:28:11.340 --> 00:28:14.900
below that of. Like I say, normal liquid helium again.

00:28:14.900 --> 00:28:18.040
think about that guys 2.2 kelvins.

00:28:18.040 --> 00:28:21.500
right? Probably member chemistry absolute 0.

00:28:21.500 --> 00:28:24.790
Kelvin's were only two.

00:28:24.790 --> 00:28:27.880
and a bit degrees above absolute 0.

00:28:27.880 --> 00:28:30.900
ro. That's also why that magnets a little hard to tell from.

00:28:30.900 --> 00:28:33.740
the picture the size of the scale of it.

00:28:33.920 --> 00:28:36.990
It's a pretty huge magnet, and that's because around that liquid.

00:28:36.990 --> 00:28:37.560
helium.

00:28:38.240 --> 00:28:41.310
It's actually a large bath of liquid nitrogen and the sole.

00:28:41.310 --> 00:28:44.480
purpose that liquid nitrogen, which is about 100 kelvins, is to.

00:28:44.480 --> 00:28:46.680
help keep that liquid helium cool.

00:28:47.580 --> 00:28:48.200
OK.

00:28:48.790 --> 00:28:49.970
So.

00:28:50.570 --> 00:28:53.780
So I talk a little bit. I mentioned some of these things here.

00:28:53.780 --> 00:28:56.840
stuck a little bit about the biochemistry. Give you guys a little bit.

00:28:56.840 --> 00:29:00.320
of the sense of what's going on, what we experiments we can do.

00:29:00.320 --> 00:29:00.320

00:29:00.900 --> 00:29:03.920

So this is the same. I know it looks a little different.

00:29:03.920 --> 00:29:07.200
but this is just a model representation of that insect antifreeze.

00:29:07.200 --> 00:29:08.780
protein. I was telling you about.

00:29:10.340 --> 00:29:13.530
And as I mentioned, a little bit before.

00:29:13.530 --> 00:29:16.650
proteins, hopefully if you've learned there made out of amino.

00:29:16.650 --> 00:29:19.890
acids, there's 20 different amino acids.

00:29:19.890 --> 00:29:23.250
that E here is just a single letter code standing for certainly no acid.

00:29:23.250 --> 00:29:26.290
known as three. Need an in really all I want you.

00:29:26.290 --> 00:29:29.510
guys to know about 3 miss that has a hydroxyl H.

00:29:29.510 --> 00:29:32.750
group off the side and you might be thinking that's.

00:29:32.750 --> 00:29:36.110
perfect, right? H water H2O hydrogen.

00:29:36.110 --> 00:29:38.370
bonds, right uniform interactions.

00:29:39.230 --> 00:29:42.340
It's a little more complicated, and that is actually looks like it's the methyl group.

00:29:42.340 --> 00:29:45.440
which stands for CH3 and some of.

00:29:45.440 --> 00:29:48.550
you might be thinking like wait. I thought I learned that.

00:29:48.550 --> 00:29:52.390
there's something called hydrophobicity and that means water hating and.

00:29:52.390 --> 00:29:52.390

00:29:53.150 --> 00:29:56.610
Methyl carbon CH3 groups are Water and yeah.

00:29:56.610 --> 00:29:59.810
I know it's something I still kind of wrapping my head.

00:29:59.810 --> 00:30:01.510
around, but we think we know it.

00:30:02.440 --> 00:30:05.470
We think we understand that yes, it is actually those methyl.

00:30:05.470 --> 00:30:07.460
groups that are important for interacting with ice.

00:30:08.020 --> 00:30:11.110
Really all I want to show you here is something that we do a lot in molecular.

00:30:11.110 --> 00:30:14.550
cell biology biochemistry then that.

00:30:14.550 --> 00:30:17.900
is mutate, change the nature.

00:30:18.600 --> 00:30:21.730
Of those amino acids, we don't have to worry about what that.

00:30:21.730 --> 00:30:25.130
hange is just the idea that we can probe how approaching

00:30:25.130 --> 00:30:28.360
ng works by changing the.

00:30:28.360 --> 00:30:31.750
amino acids in that protein sequence and.

00:30:31.750 --> 00:30:34.810
really, what I want to get out of this slide. Here you see.

00:30:34.810 --> 00:30:37.900
we've got different. 3 means different colors.

00:30:37.900 --> 00:30:38.910
in red.

00:30:39.680 --> 00:30:42.790
Right and yellow and one in green, and the point is we make.

00:30:42.790 --> 00:30:45.970
this mutation. We make this change to kind of probe well.

00:30:45.970 --> 00:30:48.990
which part of the protein which faces a protein.

00:30:48.990 --> 00:30:52.020
is interacting with ice and the red shows.

00:30:52.020 --> 00:30:55.030
if we change those residues we lose a lot.

00:30:55.030 --> 00:30:55.800
of activity.

00:30:56.700 --> 00:30:59.750
The ones in yellow said we lose some.

00:30:59.750 --> 00:31:01.970
not alot. I'm percent base is about.

00:31:02.860 --> 00:31:06.270
We lose 30% for the yellow. The red in contrast.

00:31:06.270 --> 00:31:09.730
we lose about 80 to 90 to sometimes close to 100%.

00:31:09.730 --> 00:31:12.920
so there's some effect in green this guy here.

00:31:12.920 --> 00:31:16.070
yet similar kind of meeting lasted the three mean it's.

00:31:16.070 --> 00:31:19.130
pointing away. It's hard to tell, but it's pointing away through the sort of.

00:31:19.130 --> 00:31:20.700
the through the back of your screen.

00:31:21.350 --> 00:31:24.430
And that's just to show like I'm not any read Mutation is going to have an.

00:31:24.430 --> 00:31:27.890
effect, right? Just like any good science experiments.

00:31:27.890 --> 00:31:31.480
specially in biology and biochemistry, we need to have.

00:31:31.480 --> 00:31:35.220
negative controls. We need to make sure that yeah, making any change.

00:31:35.220 --> 00:31:38.450
doesn't mean anything. Sorry, but making any change.

00:31:38.450 --> 00:31:42.090
causes and effect or change that we know a positive control.

00:31:42.090 --> 00:31:45.120
on so controls so important in biology.

00:31:45.120 --> 00:31:48.350
to make sure that what we're looking at, what we think is happening.

00:31:48.350 --> 00:31:51.200
is actually happening. We're not just misinterpreting it.

00:31:53.180 --> 00:31:56.640

So this is just again similar kind of view, but now.

00:31:56.640 --> 00:31:59.770
we're looking talking about binding and why.

00:31:59.770 --> 00:32:03.150
we think the sorry should have mentioned before SBW.

00:32:03.150 --> 00:32:06.210
spruce budworm. It's the particular insect.

00:32:06.210 --> 00:32:09.790
it comes from. It's actually a pass in northern Ontario.

00:32:09.790 --> 00:32:13.040
so it's interesting being able to control and eradicate it.

00:32:13.040 --> 00:32:16.230
So this particular protein right? These are where.

00:32:16.230 --> 00:32:19.490
those three means are. We know that's how it binds and remember.

00:32:19.490 --> 00:32:22.930
how I mentioned before there's multiple planes of ice, right? The basil.

00:32:22.930 --> 00:32:24.210
in prison planes?

00:32:24.270 --> 00:32:27.430
We think that's the reason why is protein so good?

00:32:27.430 --> 00:32:30.660
at preventing ice crystal growth? White has that high.

00:32:30.660 --> 00:32:33.890
activity at high thermal resister resource activity so.

00:32:33.890 --> 00:32:37.900
combined two different planes of ice right prism face but small.

00:32:37.900 --> 00:32:39.970
text in there. The Basil plane.

00:32:42.970 --> 00:32:44.240
So.

00:32:45.500 --> 00:32:47.340
Another coup questions and we're going to.

00:32:48.030 --> 00:32:51.100
Change gears a little bit. OK, so before I hit the.

00:32:51.100 --> 00:32:51.900
next button.

00:32:52.580 --> 00:32:56.040
So you remember I talked about how some insects?

00:32:56.040 --> 00:32:59.480
sorry, some organisms like the insect here is able.

00:32:59.480 --> 00:33:02.730
to prevent damage from freezing by.

00:33:02.730 --> 00:33:04.020
preventing freezing.

00:33:06.080 --> 00:33:09.590
Right, if you don't freeze well, you shouldn't suffer the damage above freezing.

00:33:09.590 --> 00:33:09.590

00:33:10.240 --> 00:33:13.290
But if you might recall also said some insects.

00:33:13.290 --> 00:33:16.570
inoculate freezing they promote freezing to actually.

00:33:16.570 --> 00:33:19.740
survive for the cold. We call them freezing tolerant.

00:33:19.740 --> 00:33:22.870
organisms and the budworm I mentioned would be an example.

00:33:22.870 --> 00:33:26.000
of a freezing intolerant right? So it's not.

00:33:26.000 --> 00:33:29.270
that can't survive freezing temperatures, it does. I mean could survive.

00:33:29.270 --> 00:33:32.990
right there? The one the protein I worked with, the.

00:33:32.990 --> 00:33:36.890
professor would initially got that protein, got it from.

00:33:36.890 --> 00:33:36.890

00:33:38.060 --> 00:33:41.410
This part where out in Sioux Saint Marie's. We're talking temperatures easily.

00:33:41.410 --> 00:33:42.730
reaching minus 30.

00:33:43.630 --> 00:33:46.680
But it's still freeze intolerant. You freeze insect.

00:33:46.680 --> 00:33:49.840
it can't survive. Now freezing tolerant.

00:33:49.840 --> 00:33:53.700
So those guys, those organisms are some bacteria.

00:33:53.700 --> 00:33:56.820
is also, I think a loss, but that's freezing tolerant.

00:33:56.820 --> 00:34:00.090
They make ice nucleating protein, so.

00:34:00.090 --> 00:34:03.460
now we're talking about the opposite of antifreeze proteins.

00:34:03.460 --> 00:34:07.170
They're not there to prevent growth there to promote.

00:34:07.170 --> 00:34:10.200
ice girls. So my question for you now is.

00:34:10.200 --> 00:34:14.280
thinking about ice nucleating proteins. I MPS.

00:34:14.280 --> 00:34:14.280

00:34:14.400 --> 00:34:17.410
Right? What would you think their structure the fold might?

00:34:17.410 --> 00:34:18.130
look like?

00:34:20.810 --> 00:34:28.160

00:34:31.930 --> 00:34:38.160

00:34:39.260 --> 00:34:48.160

00:34:55.620 --> 00:34:58.160

00:35:03.350 --> 00:35:08.160

00:35:08.160 --> 00:35:18.160

00:35:20.620 --> 00:35:21.410
OK.

00:35:22.080 --> 00:35:25.270

so now I feel a little bit better today before you guys sorry

00:35:25.270 --> 00:35:27.550
Let's profit. Sometimes the full our students.

00:35:28.190 --> 00:35:31.460
So a lot of you picked opposite to FPS.

00:35:31.460 --> 00:35:34.520
and then of course makes sense, right? So you think.

00:35:34.520 --> 00:35:37.600
yeah, this is going to inhibit ice growth you.

00:35:37.600 --> 00:35:40.880
want something promote. It's gotta somehow be the opposite.

00:35:40.880 --> 00:35:44.170
The truth is they actually have.

00:35:44.170 --> 00:35:47.540
same kind of fold. OK, we're going to talk about.

00:35:47.540 --> 00:35:48.920
that in a second.

00:35:56.080 --> 00:35:56.700
So.

00:36:02.330 --> 00:36:05.720
They look a lot. The insect FPS, the bacterial.

00:36:05.720 --> 00:36:06.540
ones now.

00:36:07.760 --> 00:36:10.790
We'll get through solar, why that might be the case.

00:36:10.790 --> 00:36:10.790

00:36:11.860 --> 00:36:14.870
So one thing I want to start thinking about or.

00:36:14.870 --> 00:36:17.770
trying to free calling number should bring it up.

00:36:18.780 --> 00:36:22.550
So it's a little hard to tell here, but you see the single letter codes that T and.

00:36:22.550 --> 00:36:25.870
d the tea, and there's a space in between, so this is a motif.

00:36:25.870 --> 00:36:29.010
motif, like a pattern that we see in not.

00:36:29.010 --> 00:36:32.070
just this but other insect Dave, please, we call it TX.

00:36:32.070 --> 00:36:35.110
where X is any amino acid teaser.

00:36:35.110 --> 00:36:37.060
Those three means I was mentioning before.

00:36:39.250 --> 00:36:39.860
So.

00:36:41.060 --> 00:36:44.700
I'm too far back now if we're looking at.

00:36:44.700 --> 00:36:48.100
here. I slipped in protein so biochemistry were lot.

00:36:48.100 --> 00:36:51.140
interesting, a lot and looking at protein sequences, what?

00:36:51.140 --> 00:36:54.380
is the composition? How are proteins made up so?

00:36:54.380 --> 00:36:57.760
you can see here? This is a single letter code I was telling you about.

00:36:57.760 --> 00:37:00.920
gathers 20 mil *****. We don't worry about the details but.

00:37:00.920 --> 00:37:02.380
if you look in the middle here.

00:37:03.340 --> 00:37:06.950
This is TXT OK so this is multi fat 16.

00:37:06.950 --> 00:37:09.670
residue, 16 amino acids positions.

00:37:10.340 --> 00:37:13.460
And you here we have the text and I remember.

00:37:13.460 --> 00:37:16.680
looking at and ice nucleating proteins, thinking like wow this.

00:37:16.680 --> 00:37:17.430
is weird.

00:37:17.980 --> 00:37:20.050
What's going on? Why is it?

00:37:21.270 --> 00:37:25.240
That we have something this is 16 resident, repeat that.

00:37:25.240 --> 00:37:28.370
Spruce. Bover AFP. I was telling you about that has a 15 residue.

00:37:28.370 --> 00:37:31.650
repeat. Yeah it's one different but similar. It's repeat of about.

00:37:31.650 --> 00:37:32.800
1516 resolution.

00:37:33.560 --> 00:37:34.120
The.

00:37:34.770 --> 00:37:37.820
But insect, any fear there sorry I.

00:37:37.820 --> 00:37:40.940
ice nucleating protein right this block these blocks.

00:37:40.940 --> 00:37:44.040
uses rectangular blocks meant to show that this repeat happens over and over.

00:37:44.040 --> 00:37:46.280
again. It's actually about 16 of 'em.

00:37:47.230 --> 00:37:50.420
And we think, and it hasn't been fully shown yet fully.

00:37:50.420 --> 00:37:53.600
proven yet. That's a question of size.

00:37:53.600 --> 00:37:57.180
so any freeze proteins tend to be small.

00:37:57.180 --> 00:38:00.240
ish. OK, very scientific work, right, smallish.

00:38:00.240 --> 00:38:02.100
but it's true. They tend to be able to smaller site.

00:38:02.780 --> 00:38:03.460

00:38:04.480 --> 00:38:07.810
Sort of an elected weight scale 10 to 20,000 daltons.

00:38:07.810 --> 00:38:11.140
Very big compared to light safe salt. But for protein.

00:38:11.140 --> 00:38:14.680
not that big an ice nucleating proteins.

00:38:14.680 --> 00:38:18.110
are much bigger. We're talking mega adults so million.

00:38:18.110 --> 00:38:19.480

00 kind of size.

00:38:21.060 --> 00:38:24.590
And what happens is right. It's actually it's because of my.

00:38:24.590 --> 00:38:27.840
PHD supervisor. He would say the question.

00:38:27.840 --> 00:38:30.810
is, it was. I thought it was really interesting it's.

00:38:31.780 --> 00:38:35.650
Why do antifreeze proteins?

00:38:35.650 --> 00:38:38.710
They must look like water right? Or at least similar water they.

00:38:38.710 --> 00:38:41.770
can buy dice or say they must look similar like they can buy.

00:38:41.770 --> 00:38:45.430
nice. I thought. Yeah, that makes sense I thought wait.

00:38:45.430 --> 00:38:48.780
why do they bind ice and not cause its growth?

00:38:48.780 --> 00:38:51.790
So the answer comes down to what I've got up here, but we call the.

00:38:51.790 --> 00:38:55.050
critical surface area of an ice embryo. So this is an.

00:38:55.050 --> 00:38:58.170
is an ice embryo meaning exactly that this is not really ice crystal

00:38:58.170 --> 00:39:02.070
is tiny little ice molecule action team C molecules.

00:39:02.070 --> 00:39:02.070

00:39:02.190 --> 00:39:07.240
Ice assemblies very small. OK, so this is extra limbs unit so.

00:39:07.240 --> 00:39:10.420
one angstrom is 10 to the minus 10.

00:39:10.420 --> 00:39:13.840
meters, so we're talking atomic scale diameter.

00:39:13.840 --> 00:39:17.040
adam kind of scale. So it's got a few though.

00:39:17.040 --> 00:39:20.160
right about a million or so angstroms across the.

00:39:20.160 --> 00:39:21.100
surface area.

00:39:22.140 --> 00:39:25.220
That is the smallest sort of area that you need.

00:39:25.220 --> 00:39:29.450
to have ice growth occur at minus 2 Celsius.

00:39:29.450 --> 00:39:29.450

00:39:30.510 --> 00:39:33.970
And the surface area of an ice nucleating protein at.

00:39:33.970 --> 00:39:36.980
that temperature is about.

00:39:36.980 --> 00:39:40.460
half that. Now you may say that's a big difference, yes?

00:39:40.460 --> 00:39:43.900
and no. Really, it's not a huge difference, and we're close.

00:39:43.900 --> 00:39:47.260
We're saying that the ice area, the Minimalise area.

00:39:47.260 --> 00:39:50.380
required to grow at minus two is very similar to.

00:39:50.380 --> 00:39:53.400
the surface area of an ice nucleating protein, and that's

00:39:53.400 --> 00:39:56.060
why it's able to act as ice nucleating protein.

00:39:56.710 --> 00:40:00.100
What about anti freeze proteins? Why can't they nucleate ice?

00:40:00.100 --> 00:40:03.320
at spruce budworm example, it's only.

00:40:03.320 --> 00:40:06.410
250 extra, so considerably manyfold.

00:40:06.410 --> 00:40:09.420
magnitude smaller, so that's why we.

00:40:09.420 --> 00:40:12.460
think a FPS can look like ice but you.

00:40:12.460 --> 00:40:16.500
don't actually have to worry or say consider it.

00:40:16.500 --> 00:40:19.630
Being able to grow ice and there has been some evidence.

00:40:19.630 --> 00:40:20.580
to show that.

00:40:22.280 --> 00:40:25.470
And that people made a since short synthetic ice nucleating.

00:40:25.470 --> 00:40:28.940
protein, but the same sizes and antifreeze protein.

00:40:28.940 --> 00:40:28.940

00:40:29.530 --> 00:40:32.840
And it was able to sort of.

00:40:32.840 --> 00:40:36.190
shape ice to kind of look similar to.

00:40:36.190 --> 00:40:39.550
the AFP. So we think that this would have some activity so.

00:40:39.550 --> 00:40:43.160
we think that this is evidence that yes, there is some similarity.

00:40:43.160 --> 00:40:44.080
between the two.

00:40:47.390 --> 00:40:50.740
Now I see for time.

00:40:50.740 --> 00:40:53.120
me, but I do want to leave some time for questions.

00:40:56.110 --> 00:40:58.230
Just get my mouse over here.

00:41:05.850 --> 00:41:09.950
Just got introduced one more other little topic, so it'll just a few.

00:41:09.950 --> 00:41:13.080
minutes more. Then I'll be happy to talk to you guys. Have any questions?

00:41:13.080 --> 00:41:13.080

00:41:13.730 --> 00:41:16.940
and think about not just above freezing now

00:41:16.940 --> 00:41:20.190
but the problems that come around freezing.

00:41:20.190 --> 00:41:20.190

00:41:20.840 --> 00:41:24.140
So this is what we work on my lab these days. We don't really work directly.

00:41:24.140 --> 00:41:27.460
on antifreeze proteins anymore, but we think about plants.

00:41:27.460 --> 00:41:30.770
and the big thing about plants is, well, they don't move.

00:41:30.770 --> 00:41:30.770

00:41:31.440 --> 00:41:34.530
Right organisms like.

00:41:34.530 --> 00:41:35.680
the insects?

00:41:36.370 --> 00:41:39.470
Right, the fish sure, and sometimes it can't really escape their environment.

00:41:39.470 --> 00:41:41.580
but still able to move a little bit around.

00:41:42.230 --> 00:41:45.500
And plants have to just kind of take whatever they can get.

00:41:45.500 --> 00:41:47.850
So think about you have problems of.

00:41:48.730 --> 00:41:50.380
Freezing right if your plan.

00:41:51.530 --> 00:41:55.000
Your problems with salt solidity that could be high salt in the area.

00:41:55.000 --> 00:41:55.000

00:41:56.380 --> 00:41:59.390
Drop you as a plant can't go to the water and drink it.

00:41:59.390 --> 00:42:01.390
You have to have the water come to you.

00:42:02.000 --> 00:42:05.070
And a little bit different from freezing cold, I know.

00:42:05.070 --> 00:42:08.230
they're related, but even if you don't necessarily freeze.

00:42:08.230 --> 00:42:10.920
low temperatures can cause a lot of problems.

00:42:11.900 --> 00:42:12.470
So.

00:42:13.140 --> 00:42:16.380
Why do I list these four? If you think about it there?

00:42:16.380 --> 00:42:19.500
actually all forms of dehydration now that red.

00:42:19.500 --> 00:42:22.580
ones obvious is like there's no water makes sense.

00:42:22.580 --> 00:42:26.040
Dehydration. How does freezing, salt and cold?

00:42:26.040 --> 00:42:29.280
give you dehydration? You have to think about it.

00:42:29.280 --> 00:42:33.060
not in terms of the absence of water, but the availability.

00:42:33.060 --> 00:42:36.340
of water. And of course freezing there's water.

00:42:36.340 --> 00:42:39.600
s water there. Ice is made of water, but solid water.

00:42:39.600 --> 00:42:42.820
ice means you don't have liquid water, so in that.

00:42:42.820 --> 00:42:45.320
case, that's what the problem is. Why you're having drought.

00:42:45.370 --> 00:42:48.570
Salt, while you might have water, but you'll have something also called.

00:42:48.570 --> 00:42:51.990
osmotic stress, right where you might be pulling water.

00:42:51.990 --> 00:42:56.020
out of the cell. So the cell sure that old water still there surrounding.

00:42:56.020 --> 00:42:59.200
cell, but it's not inside the cell and cold.

00:42:59.200 --> 00:43:02.240
kind of similar in the sense that you might not have.

00:43:02.240 --> 00:43:03.450
water available.

00:43:04.200 --> 00:43:05.560
To.

00:43:07.160 --> 00:43:10.330
Two, let's just say you don't have as much water available like the water.

00:43:10.330 --> 00:43:12.040
is not able to defuse this freely.

00:43:13.050 --> 00:43:14.780
So all these things.

00:43:16.290 --> 00:43:19.580
Cause dehydration damage this cell right?

00:43:19.580 --> 00:43:22.700
So again, what's going to speed up?

00:43:22.700 --> 00:43:26.220
a little bit? Things like enzymes, certain kinds of proteins.

00:43:26.220 --> 00:43:30.240
They need water. They're going to be damaged. Big one is membrane secrete.

00:43:30.240 --> 00:43:33.600
rupturing them into membranes, damage to the membranes.

00:43:33.600 --> 00:43:36.880
DNA. OK, we will have a lot of time to get into.

00:43:36.880 --> 00:43:40.560
it, but a lot of times they're going to dehydration. You also get oxidative.

00:43:40.560 --> 00:43:43.620
stress forming radicals, attack DNA and.

00:43:43.620 --> 00:43:46.430
also key aspect is cytoskeletal proteins.

00:43:47.210 --> 00:43:48.400
So my lab.

00:43:48.970 --> 00:43:51.990
Right, we're interested in these things called D hydrants and like.

00:43:51.990 --> 00:43:55.510
the name suggests, dehydration induced proteins. These are proteins.

00:43:55.510 --> 00:43:59.110
found in plants that can cause sort of that can protect.

00:43:59.110 --> 00:44:03.020
from these damages. Now what makes these interesting?

00:44:03.020 --> 00:44:06.170
couple more things? I want to cover? Thought to be found in all.

00:44:06.170 --> 00:44:09.350

plants. It doesn't include algy, but even.

00:44:09.350 --> 00:44:11.760
down to sort of lower plants we think they're found.

00:44:12.550 --> 00:44:15.810
They're actually a big member of this family, so this is a large.

00:44:15.810 --> 00:44:19.030
group of proteins called late embryo Genesis, Abundant Orlea.

00:44:19.030 --> 00:44:22.410
all thought to be involved somehow, and protection from these.

00:44:22.410 --> 00:44:25.890
abiotic is non biological stresses.

00:44:25.890 --> 00:44:25.890

00:44:27.150 --> 00:44:30.140
Like I said already, protect plants from dehydration stress.

00:44:31.210 --> 00:44:34.230
And this is the real interesting part for me.

00:44:34.230 --> 00:44:37.640
is a biochemist, so sequences are highly modular.

00:44:37.640 --> 00:44:41.150
eaning that you've got these bits of these sequences that shorter range

00:44:41.150 --> 00:44:44.510
ange themselves in different orders in the proteins sometimes.

00:44:44.510 --> 00:44:47.790
there, sometimes they're not there, and these proteins are.

00:44:47.790 --> 00:44:51.770
intrinsically disordered. Now I know the insect AFP.

00:44:51.770 --> 00:44:54.920
The fish FPS showed you look kind of like in a squiggle.

00:44:54.920 --> 00:44:57.950
of lines, that's true, but that squiggle is regular.

00:44:57.950 --> 00:45:01.050
and it doesn't really change these guys.

00:45:01.050 --> 00:45:01.050

00:45:01.250 --> 00:45:04.340
Their disordered, that means they don't have this.

00:45:04.340 --> 00:45:07.840
complex, but still beautiful organized structure.

00:45:07.840 --> 00:45:11.320
They just tend to flop around like kind of spaghetti.

00:45:11.320 --> 00:45:14.960
in boiling water. That's from biochemistry POV, kind of breaks.

00:45:14.960 --> 00:45:17.730
a lot of the rules that we thought we knew about these proteins.

00:45:19.660 --> 00:45:22.850
And the two particular proteins we like to work with their from vita stripe.

00:45:22.850 --> 00:45:25.910
area. That's just wild grape just happened to be the system that.

00:45:25.910 --> 00:45:27.460
we're interested in.

00:45:28.330 --> 00:45:31.760
OK, and just in the interest of time, I think I'm going to stop there.

00:45:31.760 --> 00:45:31.760

00:45:32.830 --> 00:45:36.420
But I would be happy to answer any questions.

00:45:36.420 --> 00:45:36.420

00:45:41.010 --> 00:45:44.860
Is stephanie three questions here so far?

00:45:44.860 --> 00:45:44.860

00:45:46.320 --> 00:45:47.240
First, one, is

00:45:48.750 --> 00:45:49.440
similar.

00:45:51.110 --> 00:45:51.710

00:45:52.820 --> 00:45:55.940
Not really OK, that's a good question. We kind.

00:45:55.940 --> 00:45:59.390
of call it sluggish. Water even called sometimes slushy water.

00:45:59.390 --> 00:46:03.130
but it's sort of like different scale, so we're talking bout Slush.

00:46:03.130 --> 00:46:06.350
You're thinking about ice water mixture, but if you could write.

00:46:06.350 --> 00:46:09.380
put the slush mixture to see even let it sit. I know it's.

00:46:09.380 --> 00:46:12.860
going to melt, but you can imagine you could separate the water.

00:46:12.860 --> 00:46:16.370
from the ice itself. It's kind of similar.

00:46:16.370 --> 00:46:19.830
but now we're looking at the very atomic kind of level. Like, really.

00:46:19.830 --> 00:46:23.400
etailed kind of level, so even solid ice.

00:46:24.090 --> 00:46:27.250
I would say as a little bit of sluggish water like the ice in your freezer.

00:46:27.250 --> 00:46:30.270
place lisa little bit sluggish water on top. It's just not something.

00:46:30.270 --> 00:46:31.630
we can see that easily.

00:46:33.180 --> 00:46:34.250
The next question.

00:46:36.140 --> 00:46:39.440
Magnetic works.

00:46:40.970 --> 00:46:42.610
No.

00:46:43.810 --> 00:46:47.260
No, not directly. I guess this ball is obviously some stuff.

00:46:47.260 --> 00:46:50.640
underlying there that is caused by the quarks in there, but.

00:46:50.640 --> 00:46:54.280
really all we're doing is observing the nuclei in the interaction.

00:46:54.280 --> 00:46:57.360
or shielding of electrons with that nuclei but.

00:46:57.360 --> 00:46:59.080
not really quarks directly now.

00:47:00.050 --> 00:47:03.590

I have an forgive.

00:47:03.590 --> 00:47:07.240
me, this isn't my area, so I'm going to make how do.

00:47:07.240 --> 00:47:13.520
you change the amino acids in the chain? Do you use CRISPR?

00:47:13.520 --> 00:47:13.520

00:47:14.680 --> 00:47:17.730
No, we don't use crisper, there's a.

00:47:17.730 --> 00:47:20.920
lot of different, so crisper it's good question.

00:47:20.920 --> 00:47:24.210
crisper does do mutations, but that's sort of at the organismal.

00:47:24.210 --> 00:47:28.000
level what we work with is a gene taken out, let's say.

00:47:28.000 --> 00:47:31.150
the insect. Take it out, but we put that gene into.

00:47:31.150 --> 00:47:34.300
what we call a plasmid to express that protein to make.

00:47:34.300 --> 00:47:37.410
that protein in bacteria. And in that case, we don't.

00:47:37.410 --> 00:47:40.670
have to like Crispers in a powerful, but rather complex way of doing.

00:47:40.670 --> 00:47:44.850
it. We use more of sort of older ways of.

00:47:44.850 --> 00:47:44.850

00:47:45.140 --> 00:47:48.150
Typically in the molecular biology, so things like things called.

00:47:48.150 --> 00:47:51.940
Restriction Enzymes which can cut the protests or.

00:47:51.940 --> 00:47:55.450
the double stranded DNA. We use things.

00:47:55.450 --> 00:47:58.870
called PCR, right plumbers chain reaction where we can use.

00:47:58.870 --> 00:48:02.350
primers, we can actually introduce the changes into that little bit of sequence and.

00:48:02.350 --> 00:48:05.900
amplify the change sequence. So we usually a lot.

00:48:05.900 --> 00:48:09.650
technically lot simpler way of doing that to manipulate the sequences.

00:48:09.650 --> 00:48:09.650

00:48:10.760 --> 00:48:14.270
What did you study in your undergrad?

00:48:14.270 --> 00:48:17.390
an what led you to conducting research in proteins?

00:48:17.390 --> 00:48:20.430
right? So I actually started.

00:48:20.430 --> 00:48:23.490
out as I would do my undergrad in my.

00:48:23.490 --> 00:48:26.670
grad. It was well at Queens and I started out in life sciences.

00:48:26.670 --> 00:48:29.490
which would be the equivalent to bio Med here at U of G.

00:48:31.040 --> 00:48:34.680
Didn't get into med school. It's OK, still here an.

00:48:34.680 --> 00:48:37.710
I thought I kind of wanted to specialize. I mean the life.

00:48:37.710 --> 00:48:40.740
size program is really great, but I wanted to kind of do some more focus.

00:48:40.740 --> 00:48:44.100
stuff in the short of it is an I laughed because.

00:48:44.100 --> 00:48:47.920
I've spoken to a lot of biochemistry students since and a lot of us.

00:48:47.920 --> 00:48:51.080
are like that. It's like biology I.

00:48:51.080 --> 00:48:54.320
did well in chemistry, so it's like I don't. Chemistry sounds good.

00:48:54.320 --> 00:48:57.460
And then once I got into biochemistry I think.

00:48:57.460 --> 00:49:00.560
it was maybe the fact that the idea of proteins is little.

00:49:00.560 --> 00:49:02.800
you know the idea of proteins is little machines. I mean it's not.

00:49:02.970 --> 00:49:06.310
Not exactly mechanical machines, but these little things that can do.

00:49:06.310 --> 00:49:09.800
all these different amazing things just got me to proteins.

00:49:09.800 --> 00:49:13.100
Ann. Just understanding what we call specificity.

00:49:13.100 --> 00:49:16.200
Why do proteins bind one thing but not?

00:49:16.200 --> 00:49:20.070
another? And I just? I mean that's going to fascinate me.

00:49:20.070 --> 00:49:23.240
no matter how long I live. Just I just find this stuff really amazing.

00:49:23.240 --> 00:49:23.240

00:49:25.090 --> 00:49:30.960
Why did the AFP's form the bipyramidal crystals?

00:49:30.960 --> 00:49:30.960

00:49:32.510 --> 00:49:35.840
Really good question so that ice.

00:49:35.840 --> 00:49:38.860
crystal issue that signal ice crystal on the plane was.

00:49:38.860 --> 00:49:42.620
and then talking about planar binding is.

00:49:42.620 --> 00:49:43.910
true now.

00:49:44.900 --> 00:49:47.920
Let's break this down a bit so that insect.

00:49:47.920 --> 00:49:51.420
a FPS ice crystals they form look.

00:49:51.420 --> 00:49:54.600
more like little hexagonal disks so they look more like that.

00:49:54.600 --> 00:49:57.640
crystal. I was showing that idealized ice crystal the.

00:49:57.640 --> 00:50:00.700

reason why the fish AFP.

00:50:00.700 --> 00:50:03.720
S that bipyramidal one is they actually don't bind the.

00:50:03.720 --> 00:50:06.800
size ice crystal they actually find what we call.

00:50:06.800 --> 00:50:09.840
a pyramidal plane. So they bind sort of an angle.

00:50:09.840 --> 00:50:12.860
as you find an angle right, they buy it here and.

00:50:12.860 --> 00:50:15.980
here. But what happens is ice crystal still grows but it grows.

00:50:15.980 --> 00:50:19.180
along with call it C axis that one axis going up and down.

00:50:19.180 --> 00:50:19.180

00:50:19.380 --> 00:50:22.510
And then eventually come to a tip and then of course things don't grow.

00:50:22.510 --> 00:50:23.510
anymore than that.

00:50:26.110 --> 00:50:29.120
Hey I have is it because of the high?

00:50:29.120 --> 00:50:32.400
dehydration implants due to cold and freezing that causes?

00:50:32.400 --> 00:50:35.720
some species of plants and trees to basically hibernate in the winter.

00:50:37.100 --> 00:50:40.210
That's a good question, and this is where.

00:50:40.210 --> 00:50:43.410
I'm going to say I'm a biochemist. I'm not very.

00:50:43.410 --> 00:50:45.040
good at plant biology.

00:50:46.680 --> 00:50:48.510
That's Fair, that's Fair.

00:50:49.590 --> 00:50:52.980
All this stuff. Typical answer right? I should know this.

00:50:52.980 --> 00:50:56.020
It's definitely assure part of it there's.

00:50:56.020 --> 00:50:59.230
like my thing of dehydration, and dehydrates it.

00:50:59.230 --> 00:51:03.830
Really it's one aspect, but it is a gross oversimplification.

00:51:03.830 --> 00:51:07.340
There's alot of things plants do to kind of survive the cold.

00:51:07.340 --> 00:51:07.340

00:51:08.480 --> 00:51:11.640
We have time studying AFP.

00:51:11.640 --> 00:51:13.780
More interesting in plants or animals.

00:51:15.390 --> 00:51:16.110

00:51:16.720 --> 00:51:20.070
So you can start the first. I missed the first part of the question, sorry.

00:51:20.070 --> 00:51:21.970
I have to get back to it, just a second.

00:51:24.500 --> 00:51:28.140
Do you find studying AFP more interesting?

00:51:28.140 --> 00:51:29.790
in plants or animals?

00:51:30.510 --> 00:51:31.280

00:51:33.580 --> 00:51:36.590
That's kind of asking which your child is. Your favorite.

00:51:36.590 --> 00:51:40.240
No, it really is both, and that's.

00:51:40.240 --> 00:51:43.490
because it's different, so in animals.

00:51:43.490 --> 00:51:46.660
it's interesting, because like I said.

00:51:46.660 --> 00:51:49.890
the insects are really have really good activity plants.

00:51:49.890 --> 00:51:53.140
are interesting because they have low activity like.

00:51:53.140 --> 00:51:56.760
we always stick. Yeah, we got it figured out. A FPS and plants.

00:51:56.760 --> 00:52:00.070
eah, it's to protect the plant from freezing. No the plants.

00:52:00.070 --> 00:52:03.380
kind of freeze, so one of the ideas is that maybe.

00:52:03.380 --> 00:52:05.680
it's not so much preventing freezing, let's say.

00:52:05.790 --> 00:52:08.960
Overall, re directing where that freezing occurs.

00:52:08.960 --> 00:52:12.220
in the plants because plants have a lot of mechanical structure to.

00:52:12.220 --> 00:52:15.480
prevent damage from ice crystal growth so.

00:52:15.480 --> 00:52:19.240
I find that fascinating for that reason. So I also gotta say.

00:52:19.240 --> 00:52:20.900
a say both on Radar Mazing.

00:52:22.270 --> 00:52:25.380
OK, the last two questions I have here 'cause we're coming up.

00:52:25.380 --> 00:52:28.530
so we have 7 minutes to go, but so.

00:52:28.530 --> 00:52:31.670
they kind of blend together. One is do you?

00:52:31.670 --> 00:52:34.920
offer any volunteering opportunities for undergraduate students?

00:52:34.920 --> 00:52:37.980
and the other one is? What courses do you teach at the University of Guelph in?

00:52:37.980 --> 00:52:41.820
the undergraduate? So yep. So volunteering.

00:52:41.820 --> 00:52:41.820

00:52:43.360 --> 00:52:46.850
Generally say no, just because.

00:52:46.850 --> 00:52:50.320
I don't like the idea of uncompensated labor.

00:52:50.320 --> 00:52:53.670

I have no problem if you guys get academic credit.

00:52:53.670 --> 00:52:56.730
So things like I sometimes have work study positions in.

00:52:56.730 --> 00:52:59.810
my lab 4th year projects for.

00:52:59.810 --> 00:53:02.940
sure summer projects generally I take on

00:53:02.940 --> 00:53:05.570
n students after third or so year.

00:53:07.070 --> 00:53:10.100
Projects are paid sorry summer summer.

00:53:10.100 --> 00:53:13.120
research is paid for your projects. You get academic.

00:53:13.120 --> 00:53:16.770
credit for that work, so definitely.

00:53:16.770 --> 00:53:19.950
guys I know it's I. First I didn't get through my end slide.

00:53:19.950 --> 00:53:22.960
but my end sort of point was you guys.

00:53:22.960 --> 00:53:26.160
could be working on stuff like this in three or so years so.

00:53:26.160 --> 00:53:29.260
please keep me in mind as you get in the upper years for interest in this kind.

00:53:29.260 --> 00:53:32.460
of work, definitely email me. Talk to me.

00:53:32.460 --> 00:53:32.460

00:53:33.970 --> 00:53:37.050
It generally varies a little bit. Right now I'm teaching.

00:53:37.050 --> 00:53:40.430
the what's called Chem 3560 structure, and.

00:53:40.430 --> 00:53:43.490
unction, so there's the introductory course, its course.

00:53:43.490 --> 00:53:46.570
number is 2580. I generally teach the follow up.

00:53:46.570 --> 00:53:49.630
to the introductory course. I'll sometimes teach the.

00:53:49.630 --> 00:53:52.990
4th year protein structure course. There's also a molecular.

00:53:52.990 --> 00:53:56.080
third year biology course that I teach us as well.

00:53:56.080 --> 00:54:00.290
but that does change a bit overtime, but.

00:54:00.290 --> 00:54:00.540

00:54:01.220 --> 00:54:04.230
Yeah, you kind of just. Yeah, it does change a bit, but.

00:54:04.230 --> 00:54:07.550
those are the courses I seem to be teaching the most often. At least these days.

00:54:07.550 --> 00:54:07.550

00:54:08.820 --> 00:54:12.150
Hey, I'm just going to add stuff and that I would encourage students.

00:54:12.150 --> 00:54:16.130
to look at undergraduate research assistantships or ura's.

00:54:16.130 --> 00:54:19.390
an work study on the student financial.

00:54:19.390 --> 00:54:23.490
Services website. Those are easy links to find on the Guelph website.

00:54:23.490 --> 00:54:27.170
and also recruit recruitguelph.ca.

00:54:27.170 --> 00:54:30.430
for all experiential learning opportunities at the university.

00:54:30.430 --> 00:54:34.110
ty so just to encourage you there might be other opportunities

00:54:34.110 --> 00:54:37.150
that you could pursue to get some experience so.

00:54:37.150 --> 00:54:39.520
that when you get to 2nd, third, 4th year.

00:54:39.570 --> 00:54:43.120
That you have some experience to maybe put yourself forward.

00:54:43.120 --> 00:54:47.000
for work in a lab or course. Work in a lab.

00:54:47.000 --> 00:54:48.330
like Doctor Breakers so.

00:54:51.560 --> 00:54:55.340
I don't know if you want to add anything, but it's absolutely true.

00:54:55.340 --> 00:54:58.390
Yeah, I just want one small thing. Like if you guys have some.

00:54:58.390 --> 00:54:59.710
questions.

00:55:00.350 --> 00:55:03.480
I think I put my email address on the 1st slide is pretty easy.

00:55:03.480 --> 00:55:06.140
to find. Just my last name at you wealth.ca.

00:55:06.850 --> 00:55:10.220
I don't certainly don't have all the.

00:55:10.220 --> 00:55:13.500
answers, but I'm happy to kind of direct you guys to the right places.

00:55:13.500 --> 00:55:16.930
Or if you have some questions more than happy to engage you guys.

00:55:16.930 --> 00:55:16.930

00:55:21.020 --> 00:55:24.080
Great, thank you very much. So we're just going.

00:55:24.080 --> 00:55:27.560
to tie up here 'cause we have a couple of minutes left, but Steven on.

00:55:27.560 --> 00:55:30.610
behalf of the Associate Vice President, Academic's office and.

00:55:30.610 --> 00:55:33.800
the undergraduate academic information center, would like to thank.

00:55:33.800 --> 00:55:36.960
you again this year for volunteering.

00:55:36.960 --> 00:55:40.660
to do this and to connecting with students and providing.

00:55:40.660 --> 00:55:43.720
an opportunity for them to get their minds going.

00:55:43.720 --> 00:55:47.300
An looking at some opportunities that might go who?

00:55:49.330 --> 00:55:52.430

So you may have some potential grad students.

00:55:52.430 --> 00:55:55.450
we had at the height of our presentation today we had 100 and.

00:55:55.450 --> 00:55:58.630
endees, so that's great.

00:55:58.630 --> 00:56:01.730
for things that we don't force people to attend, but we invite.

00:56:01.730 --> 00:56:04.810
them to attend. I think that's amazing, so thank.

00:56:04.810 --> 00:56:08.880
you very much for taking the time to do this with us today. It's my absolute.

00:56:08.880 --> 00:56:12.190
pleasure and hopefully it'll hoping maybe next year.

00:56:12.190 --> 00:56:16.240
I can see some of you guys on campus in person, absolutely.

00:56:16.870 --> 00:56:20.790
OK, have a great day everyone. Thank you for joining us guys.

00:56:20.790 --> 00:56:20.790

00:56:22.070 --> 00:56:30.820

00:56:30.820 --> 00:56:37.810