You’re listening to Fungi Town and this is episode 15: The Fungus Olympics.

[Fungi Town Theme Music]

[0:00:15]
Welcome to Fungi Town, where we are amused by mazes, absorbed by obstacles, and astounded by speed. I’m your host and mayor of Fungi Town, Jen Parrilli. Today, we’re going to begin our four-part series about the Fungal Olympics. Joining me will be one of the event’s organizers, Dr. Daniel Irimia from Harvard Medical School, and we’ll hear from several of the olympic contestants.

[fanfare]

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The Olympics. I’ve never been much of a sports fan, but one competition I do make sure and tune into every time is the Olympics. It’s fascinating to see so many people from so many different cultures all together in one place. The outfits, the amazing performances, the emotions of those who win and those who fail…frankly, it’s just fun to see people doing things I couldn’t even imagine achieving myself.

That’s why, when I ran across the Fungus Olympics, I was immediately intrigued. What kind of acrobatics can fungi do? What challenges will the contestants face? How did this whole idea get started? So, I started looking for answers, and fortunately, I found some. Both the organizers and contestants reached out from all over the world to share their stories with me. So much so, in fact, that I’m going to tell their story in four parts; two leading up to the competition and then two to follow-up episodes with the contestants to see how they did and what they learned. I’ll spread these episodes out in the next few months, so keep your ears open for more fungal olympians.

First, let’s get some background on the competition from one of the event’s organizers.
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I am Daniel Irimia. I’m an Associate Professor at Massachusetts General Hospital and Harvard Medical School in the department of surgery.

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And you're one of the people who’s putting together the Fungus Olympics, right?

DI: Yes. I've been trying different ways of getting biologists engaged with using new technologies and the Fungus Olympics is the latest thing that seems to gather a lot of interest.

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The Fungus Olympics competition officially begins in February and although 2019 will be the Fungus Olympics' inaugural year, this isn't the first time Dr. irimia has experimented with microbial athletics. He's also been involved in a few other races, including a competition of Dictyostelids, which are slime molds. Although slime molds were first thought to be a kind of fungus and are often covered in mycology courses, they are now classified in their own category of organism. Several cool videos of slimes molds can be found online. Navigate to Fungi Town's YouTube channel and click on playlists to see some good ones.

[0:03:04]

DI: It's first year when we do Fungus Olympics. Before that, we started with a cancer cell race. So, we were racing cancer cells and everyone was asking, why do you want to see what is the fastest cancer cell? They're bad. You should look for the slowest cancer cell. That's not a competition, who can go slow. And then because of our work, we do a lot of work with neutrophils, so we had a neutrophil race and we found that there are not that many competitors because there are not that many groups working on neutrophils, and then we did the race on Dictyostelid. And that was the Dicty cell race. That was quite a success, I would say, because it really engaged the Dictyostelid community, which is very organized and very friendly. We also got one reporter from *The Wall Street Journal* came to our lab to learn about what is this slime mold race. So we did that, and now the last thing is this fungus race, which is getting more people engaged than we expected, which is very nice.

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Can you explain what neutrophil is?

DI: A neutrophil is one of the white blood cells, so in your blood you have red blood cells that transport oxygen to tissues, and you have white blood cells that protect you from infections.

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Can you tell me a little bit about the history of the Fungal Olympics?

DI: Yes, so the Fungal Olympics started, I would say quite serendipitously. So because we were interested in neutrophils, two years ago we published a paper on how neutrophils interact with *Aspergillus* hyphae.

Aspergillus is a group of fungi, some of which affect human health in negative ways. So when the human body gets infected with one of these fungi, it sends out the white blood cells, or neutrophils, as a defense. But *Aspergillus* is smart and it splits apart to try and steer clear of the body's defenses.

DI: So it's like, you know, the classical story of Hydra, that grows multiple heads. You cut one and it grows ten. So the *Aspergillus*, does the same.

Once they discovered the ability of this fungi to navigate the neutrophil obstacles, Dr. Irimia and Dr. Momany decided to find out how different fungi were able to respond to certain challenges. An thus, the Fungus Olympics was born.

> DI: So we published that paper and then, it was Michelle Momany, our collaborator in this Fungus Olympics that sent me an email that said, well, what you see with hyphae and neutrophils is fantastic. This would be very nice tools to use in my lab, she said. So we started talking and we realized that yeah, that would be nice to use in any lab looking at filamentous fungi. So, you know, it was very easy from there to say well, we have this competition between cells, why don't we make it about fungi? So that's how it started.

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Tell me about the actual competition. What does it involve?

> DI: Well, the actual competition - so if you are, let's say a researcher in a lab that you work with some filamentous fungi, and you sign up for the race, you receive a dozen microfluidic devices by mail sometime in January, so you can start playing with them and start loading some of the devices. And then in February, we'll schedule a time when you'll have a microscope delivered to your lab. So we work with a company in the Netherlands that developed a microscope that is as big as - I don't know - as a pack of cigarettes if anyone remembers what a pack of cigarettes is. And it's a very interesting concept for a microscope because it connects to the internet, and it holds the images that it acquires every ten minutes for, let's say, ten hours go on the cloud. So the person running the experiment can see what's happening from anywhere. We can see what's happening in his lab, you know, in the microscope. So that's going to be the actual competition, the person would put his favorite fungus in the microfluidic device and will start imaging, and see how the filaments grow towards the different channels that we make. There will be challenges like branches, and tiny spaces that the fungus would have to go through. So then at the end of February, I think we'll have all the labs run their experiments. And that's when we'll start the analysis. There will be some preliminary analysis to decide who the winner is and announce it. But then there will be more detailed analysis. We may ask some of the labs to repeat the experiment a couple of times, so we want to write a paper about all the observations, what observations are made as part of this big crowdsource experiment, pretty much.

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So the fungi are put into a maze, right?

> DI: Yes.

So is that like a Petri dish filled with some type of medium? Can you tell me more about what that part of it looks like?

DI: Yeah, so the devices look like a Petri dish, and in the middle of the Petri dish we have a microfluidic device that has tiny channels. So you pipette the fungus in the middle, and when it germinates and starts growing into filaments, some of these filaments will have to grow through the channels. There's no other way for them to go after the food source. And those channels pose a challenge by size, by the fact that they branch, by different other obstacles that we put in front of them. So if you think about the Petri dish, it's just a flat surface on which the fungi can grow. We put some microscale structures on that surface, so now it becomes more interesting. So it's a more sophisticated Petri dish, yes.

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How are you going to decide who's won the competition?

DI: So in terms of rules, what we say is that the lab that finds the fungus that grows the fastest through the channels, that reaches the end of the channels in the shortest time, that would be one winner. The fungi that grows the fastest through the narrow channels, that could be another winner. Fungi that grows along the shortest route between the entrance and the exit in the channels that bifurcate, that will be also the smartest. So it will have a few winners, based on rules. But I think everyone is going to win if everything goes well and we get interesting movies, and we get people's attention outside the field about this competition, I think everyone is going to win.

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Who's eligible to take part?

DI: It's an open Olympics at this time because it's the first race. Anyone who likes fungi and works with invasive fungi and wants to see invasive fungi under the microscope. There's really no, I would say, no barrier. If they're science labs that sign up mostly, because that's, again, that was easier for us to reach. We had inquiries from people that teach about fungi in their classes, biology classes, and they wanted to see how we can make this race somehow into a lab that students could get engaged into. And we're still discussing about how to make this race part of the lab experience for students. You know, they're - with the classes because we are in a fixed time frame, you have to start thinking ahead of time. Yeah, so and then there are many research labs in the industry that deal with fungi for different applications. So they would be welcome as well.

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So far, how many contestants have signed up?

DI: So far we have close to 30 - 29. And they are from 11 countries on five continents.

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Are they all academic research labs?

DI: Yes. They are all academic research labs. I think it's how the race started, with the announcement, and the Twitter. But we're trying to engage also more people from the education side, and maybe researchers who have ties in the industry. If they want to do something, if they have enough time on their hands to do one more thing.

[0:14:30]

Is the enrollment period still open? Or when is the deadline for that?

DI: Yes. So the enrollment is still open because now we have devices that we feel confident that the majority of the labs will be able to use. We are restarting our Twitter campaign to get people to sign up. So it's going to end at the end of December.

[0:14:56]

What's the ultimate goal? What are you hoping to get out of the project once it's finished?

DI: For my lab, the ultimate goal is to learn about how innate immune cells like neutrophils interact with fungi and design better devices to test this interaction to learn how to control the fungal infections in patients better. That's our ultimate goal. The Fungus Olympics is just one step, which is very important, where we engaging more of the people that have expertise on the fungal side.

[0:15:39]

Are you going to be sharing the research that results from the competition?

DI: Oh, absolutely. Yes. Yes. We want to make it as open as possible. So, everyone who participates in the Olympics will have access to the movies that we generate. For each lab, we'll know what species, and if there are mutants, what mutations these fungi have. After the race, when I was talking about the detailed analysis, we would like to put everything we learned into a scientific paper that we can publish.

We did this a couple of years ago when we ran the Dicty race, we had a paper that was quite interesting where it compared, I think, 12 different strains of Dictyostelid, with different mutations going through mazes; which was the fastest, which was the smartest, and why did one win and others lost. So, we learned in that race for example that the cells that are moving the fastest, they're not the most efficient at crossing a maze, and the winner was a cell that had a good balance between being precise and being fast. And it was a little bit unexpected. We thought, well, the fastest is going to win. It's going to make more mistakes, but in a shorter time. So there are unexpected things when you do experiments on this scale, you learn something new. If one lab would want to test, let's say, 20 different types of fungi, it's probably going to take two or three years to run that experiment. With this Olympics I think we'll get the result in a couple of months. So everything is accelerated by this crowd source experiment.

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That sounds like a great way to get a lot of data in a shorter amount of time.

DI: Yes. That's one of the goals is to learn quickly. Also we hope that this sort of crowd source experiments will become a model for doing other things. You probably know that there are other efforts in crowdsourcing science, and also getting scientists involved, so that's part of a bigger game, so to speak.

[0:18:22]

So if there's anyone listening to the show that's interested in sponsoring, how do they get in touch with you and become a sponsor?

DI: They should go to the FungusOlympics.org website. They can find an email there. They can find us on Twitter, with Fungus Olympics. I think we are easy to find. We are all people involved in academia, so we are all probably people, so it's easy to find us. Yes. I hope it's so easy, as you say, that sponsors will try to find us. It's the other way around, we try to find sponsors and get them excited about what we want to do, and they say yes, we want to help out.

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Do you have a favorite fungus? Just a personal favorite?

DI: Well, I think that's why the Olympics is going to happen, because I don't have a favorite fungus. I have really no horse in the game, so to speak.

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So you're impartial.

DI: Yes, so after this race I'll probably have a favorite fungus.

[0:19:37]

That's a good way to decide.

DI: Yes. And also you have to understand that the direction that I'm coming from is neutrophils, the immune response to invasive fungi that are medically relevant. So far, we've worked with *Aspergillus* with *Candida* which are the top fungi, as medical problems. That's quite limiting, right? It's two out of probably, you probably know better, there are probably thousands of fungi.

Oh definitely, at least.

DI: I hope we find our favorite after the Olympics.

[0:20:18]

Is there anyone who's doing fungus research right now that you're really excited about their research besides your own?

DI: I think every one of the labs that sign up for the Olympics is doing amazing research with fungi on their own, and they're all very talented scientists, very passionate. I think everyone should listen to your podcast when you interview them to learn more about exciting things in the area of fungal research.

[0:20:57]
Yeah, definitely, the more people who listen, the better.
DI: Yes.

When we come back from the break, we'll talk to our first set of Olympic contestants to find out about the fungi they work with and why they joined the competition.

[0:21:14] **Break:**
It's that time of year again. Yes, that's right, whether you love them or loathe them, the holidays are just a few short weeks away. Lucky for you, I've got the perfect solution for all of the fungi friends on your list. It's LichenLandscapes.com. Where you can peruse Haley's beautiful collection of lichen prints. Pick one up for your professor, your group leader, or your foraging partner. And while you're there, LichenLandscapes.com has a great selection of cards. Each set features a gorgeous, hand-drawn illustration of a different lichen. They make perfect gifts too, or treat yourself to a set. They make great thank-you cards! And now, Lichen Landscapes and Fungi Town have a holiday surprise for you! You can get 10% off of your entire order when you enter the promo code "FungiTown." Not only will you save 10% for yourself, you'll also be giving back to the podcast because a percentage of your order will go to support the show. So get your holiday shopping under way at LichenLandscapes.com. What are you waiting for?

[0:22:16]
Welcome back. Before the break we talked to one of the organizers of the Fungus Olympics and got an overview of how the competition got started and what the contestants will face. Now, let's hear from the other side of the story, from some of the contestants themselves.

My first guests are a team of scientists who work together and will enter their organisms from a lab in California.

[0:22:38]
My name is Derreck Carter-House. I'm in Jason Stajich's lab at the University of California in Riverside. And I like to study how microbes fight each other. So I'm looking at bacterial and fungal interactions.

I'm Jesús Peña. I'm also in the Stajich lab at University of California - Riverside. And I study sexual development in the zygomycetes.

And I'm Jason Stajich. I'm in Stajich lab also at University of California at Riverside and I'm a professor and working on mycology, evolution in fungi, and we use genomic approaches to that, but we also do experimental work and we're interested in a bunch of different kinds of fungi, but zygomycetes are one of our main interests in the lab.

[0:23:27]

Okay, cool I was reading a little bit about the Zygolife project. Can you tell me some more about that?

JS: Sure. This is Jason. I'll start with that. So, this is a project to try to study the diversity of this group of fungi that were previously classified all into one phyla called the Zygomycota. But actually they are two distinct phyla that we've found through some of the work that we've been doing to study their evolution. And the Zygolife project is an attempt to try to gather up more information about this group using genomic approaches and resolving the evolutionary tree of these organisms. And also incorporating into that tree information about morphology, how similar are some of the ways that these grow or reproduce, and putting that into a phylogenetic context. We can look at that in the context of the tree, of the history of the organisms. And we're also incorporating fossil data that's been collected to try to date when some of these groups diverged. And so we can try to put that into geological time using some different approaches. So it's really kind of an integrative approach that was sponsored, or supported by an NSF grant that has many different labs sort of forming, PIs, but a host of collaborating labs to try to look at the evolution of this group and bring together different kinds of data to decorate the tree in a way. So that's been the goal of this project.

So we have a host of collaborators all focused around this group of fungi that have been not as well studied... I mean, they've been well studied in the past, but we're trying to bring a lot of modern, and data driven approaches to exploring their biology.

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So, talking about the zygomycetes, can you tell us why they're special, like how they're different from a fly agaric, or a mycorrhizal fungi or something like that?

DCH: I think I might get into a little trouble for this, but zygomycetes are simply the best of the fungi. So we've got a couple of responses, and so I'll just kind of tackle one aspect. I want to talk about the diversity and the beauty of the zygomycetes. There are all kinds of shapes and different morphologyiesin the zygomycetes, and just the places that they're being collected from are very unique. And so from a pile of rat dung in the desert you can get some incredibly diverse zygomycetes, but also beautiful ones. So they can be shaped kind of like little Christmas trees. There's like, ornate disco ball shaped zygos, and then we've got some spikey looking dangerous, kind of mace like zygotes. So there are lots of shapes, and lots to be found, to be explored there. And so I think if we are talking about that aspect, it's kind of unique from a lot of other fungi that you can look at with your eyes. These are just small enough that you need to use a magnifying glass or a microscope, but still very beautiful.

[0:26:56]

Do they develop hyphae?

DCH: They do. So most of these are hyphal. There is one that maybe I'll talk a little bit about later. It's dimorphic. It's one of my favorites. It'll form a yeast.

JP: I think the zygos really represent that transition from the fungal life habit of being single cellular or flagellated to growing as these multicellular mycelia.

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So they're kind of an evolutionary link?

JS: Absolutely. I think that's a good… We're trying to explore how, so the fungi that are flagellated represent what have been called Chytrid fungi, that are two phyla. And they have a flagellated structure. And then zygomycetes are kind of the sister group - can be sister to this group. So we're trying to understand when the flagella was lost. Was it lost at the base of when zygomycetes formed, was it lost earlier, or was it lost multiple times, has been a big question in fungal evolution based on looking at the phylogeny and looking at these traits. And so, like Jesus mentioned the elaboration on multicellular growth, we see that in zygomycetes, and that might be independent of some of the elaboration of multicellular growth that we see in dikarya fungi. And so like fly agarics, or the molds that you would see on your rotting orange. But one other thing about, sort of, because fungi break things down, right? So we get to study stuff that's kind of rotten or soils, or dung. But one interesting thing about zygomycetes in terms of their ecology and the lifestyle is they're often the first ones to show up on some of these environments. So if you take dung, which is a really great, you know, teaching mycology lab, it's kind of one of the cool labs to do to watch things grow out of dung, if you're into seeing cool things grow. And zygomycetes are often the first things that show up there because they tend to get some of those easy to acquire sugars. So they grow pretty fast. So I think they're interesting to us also in terms of what - some of these tend to grow a lot faster than other fungi, so what's the biology underlying that and how do they get there first, or how do they succeed first is an interesting question to understanding them.

[0:29:26]

Is the Hat Thrower Fungus a zygomycete?

JS: Yeah, *Pilobolus*. Yes.

DCH: Yeah, I think you mentioned in your first episode that *Pilobolus* is the fastest organism on earth, and it's got a force of 20,000 Gs it's pulling when it launches off of that dung, so I think we've got this competition in the bag.

[0:29:50]

Speaking of the competition, how did you learn about it?

JS: So, I guess I can speak. So I was introduced to Professor Irimia and through Michelle Momany who is also interested in part of the Fungal Olympics. And so they just contacted me, I think through email, and then we spoke at a conference about the goals, and the interesting ways of capturing measurements of fungal biology, fungal diversity, how different can these organisms grow under certain conditions, especially these sort of obstacles and sort of pressure testing feats of strength that we're going to be able to test these on. And so I think that it's super fascinating to us because we would love to see how these things all compare and maybe understand if any of the genes that we're identifying that are regulated in some of the growth forms, if those are important in some of the biology and the traits that we can observe. So we're all for that and also the idea that multiple labs can be involved in this. I think it's really exciting to have a virtual collaboration through something like this.

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Which organism are you going to enter into the contest, if that's something you can tell me about?

DCH: I think we can divulge that. If not, I guess you can just bleep it out. We're going to put in *Rhizopus stolonifer*, so the mold on your strawberries, the black bread mold. We're also entering *Mucor circinelloides*, I believe. And then we also entered *Phycomyces blakesleeanus*. So those three kind of faster growing of our collection.

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So are you all competing against each other, or do you get to enter all three for your lab?

DCH: That's the Stajich Lab's contestants.

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So why did you choose each of those individual fungi?

DCH: So I have been working with *Serratia marcescens*, a bacteria, and *Rhizopus stolonifer* just has a post-harvest rot… It's not a pathogen, but as a post-harvest rot organism. And I was kind of interested in slowing down its growth or using bacteria in some way to kind of preserve our strawberries, or preserve the food. And so what we found was *Rhizopus* grows so fast that it's actually kind of a challenge to slow it down. So I think *Rhizopus* for that reason. We also have *Mucor*, which is another fast grower that was kind of neck and neck with *Rhizopus* in there. So just based on those observations alone we kind of want to throw them in the competition. *Phycomyces* is Jesus's baby, so…

JP: Yeah, so I picked *Phycomyces* because it's got a pretty powerful model of the physiology of sensing the environment. So, *Phycomyces* is great at doing that. Out of the five senses that we associate with humans, it's got four of them. It can smell, it can taste, it can, well, it can't hear. It can see. What am I missing? Yeah, it can touch. It can feel obstacles. So it'll respond to wind, or light, smells, and obstacles that are in the way. It's able to avoid them by smelling them.

JS: I think also overall these are pretty fast growing organisms in our lab. So if we're going for the sprint, you know, we felt like these are ones that we noticed grow quite fast in our lab. And I think *Phycomyces* we kind of think of as a strong man in some ways because it's got really thick hyphae. It's really fun to look at under the microscope because it's actually quite big. So we're hoping that it might win in some of those obstacles that may advantage things with bigger hyphae.

DCH: I think all of us would laugh at us bragging about how big hyphae are under a microscope.

JS: Well, I know. But I think it's interesting to see. From a scientific standpoint we're really interested in what these measurements might tell us and if these are appropriate ways in the future to really develop systematic measurements that are pretty easy to do, then we might be able to look at variability in these kinds of traits across more strains or more species.

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What do you think some of the challenges or obstacles are going to be in the competition for your particular species?

All: Do we know? Do we know?

DCH: Yeah, so I'm trying to think about Jessie Ewing's work as she put her... So a lot of times her hyphae would fall off out of the image or whatever it is. So I'm just kind of wondering...

JS: So there's channels that they'll grow through, and those will have sometimes angles, from what I've seen the pictures of. And maybe Dr. Irimia will speak more about the specifics, but I feel like there's going over things going through things, there may be some pressure tests to see how much pressure a hyphae can generate, and then navigating, again, sensing something to at least navigate where are the open spaces. So presumably there will be differences in how well they do that.

DCH: Yeah, I think one interesting aspect that kind of sets us apart is that our hyphae are coenocytic. So they don't have these little septa dividing all of the cells. And so I'm wondering if that's going to play any role in our ability to elongate and move all the way through the microfluidics chamber, or if other people with septate hyphae will have an advantage because they've got a little more structure to put more hydro pressure behind the growing root of the fungal tip.

[0:36:14]

Do you think the species with the thicker hyphae is going to have more difficulty, maybe, navigating some of those gaps?

JS: I don't know. I guess it depends on how tight it is. I mean, there are some beautiful videos that have been taken of *Phycomyces* kind of avoiding obstacles, or at least avoiding a barrier, noticing it before it reaches it. So I guess I'm curious to see on this microfluidic scale if we'll be able to see that sensing and maybe even get an understanding of how precise the cells can really detect their obstacles. I don't think we really know how it's going to behave. We've only seen a little bit of information about the prior results and the kind of way this is going to go. So I guess we're really curious to see what happens.

[0:37:06]

If you paid attention in science class, you already know that our genes - the things that determine what color hair we have, how tall we grow, and probability of resisting certain diseases - get passed down to us from our parents. But sometimes those genes get changed while we're alive. Maybe we get really sick and that illness causes our genes to react in a certain way. Or we get exposed to a chemical that attaches itself to those gene molecules and mutates them. Now that our genes have changed, will we pass these modified genes on to our children? My next guest comes to us all the way from Finland and he uses fungi to study this very question.

[0:37:48]

My name is Ilkka Kronholm and I work as a researcher at the University of Jyväskylä in Finland. And what I'm really interested in is the role of epigenetics in phenotypic plasticity and evolution. So and by epigenetic changes I mean changes in chromatin modification. So things like DNA methylation and histone modifications. So maybe I should sort of expand a little bit what those are for the listeners?

So the activity of genes is regulated mainly by transcription factors. But in the recent years people have found out that there are also these sort of a little bit more permanent modifications that are put onto DNA. So for example DNA methylation is covalent modification of certain base pairs so for example, cytosines in DNA. And that can turn genes on or off. And what's sort of like, what's interesting and surprising about some of these epigenetic modifications is that we learn that this actually can be inherited. So sort of that state of gene expression can sometimes be passed to the next generation. So this happens in things like, so it happens in animals and plants, and also fungi. For example, animals if you've heard of genomic imprinting. So that means that certain genes that come from your mother are expressed, and certain genes that come from your father are expressed, but certain genes that you get from your father are not.

[0:39:34]

So when you say genetic modification are we talking about something that happens naturally or something that's done in a lab?

IK: So this epigenetic modification, so here I mean sort of naturally occurring changes in the genome. For example, DNA methylation has been known to occur for quite a long time. But long time it was thought that most of these DNA methylation changes are erased when gametes for the next generation are made. But it turns out, and especially if you look at some... So this sort of like, this idea that everything or most of it is erased came from mammals, so from mice. Because it seems that in mammals most of it is really erased. But then if you look at things like plants a lot more of it remains. So, and people have shown in plants that there are these sort of effects that if you, for example, stress some plants, then they change some of their epigenetic changes, and then their next generation then has a different phenotype. So this sort of phenotypic plasticity that also can be inherited. And so sort of the other way to think about these epigenetic modifications is that some of them seem to happen spontaneously. So there are spontaneous changes, which are sort of analogous to genetic mutations. And what I'm being interested in is that okay, if we have these sort of spontaneous changes, in theory those could be raw material for evolution as well. And what I've been doing for the past years is I've been investigating this question from different perspectives using some theoretical models and experiments. And I've actually only, I've started working with fungi four years ago now, and so I'm working now with the fungus *Neurospora crassa*, which is a filamentous ascomycete. And *Neurospora* is sort of a very old genetic model system.

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What makes it a good model system?

IK: *Neurospora* is a good model system because it's very simple to cultivate in lab, and it has a sort of facultative sexual life cycle, so you can propagate it asexually. So, because it makes different types of spores, so it makes asexual spores. But then you can induce sexual reproduction by changing the environment, and then you can make crosses if you need to do that. So it makes genetic analysis easy because you can do mapping. And in terms of like, this modern molecular biology methods, it's very easy also to manipulate genetically, so you can do genetic modifications quite easily, and there have been these big projects where people have deleted almost every gene from the genome, so it's easy to have mutants available for most of the genes in *Neurospora*. And also a very nice aspect of it is that you can put the spores in the freezer and they will stay there for a long time, and you don't have to worry about it, like storage issues and all of this stuff.

[0:43:27]

So your main focus is kind of figuring out gene expression and the way that those genes are inherited?

IK: Yeah. Yeah. So, what I've done so far with *Neurospora* is that I've looked at the role that these epigenetic modifications have, sort of within generation responses to different environments. So what I've done, for example, are experiments where I grow the different mutants that lack these different sort of epigenetic modifications. So for example a mutant, where the gene for DNA methyltransferase, so the enzyme that makes that modification has been deleted. So they're not able to use this modification, and I grow them in different environments to see like, are some of these environments or responses impaired.

[0:44:20]

So do you have everything in test tubes or petri dishes? What does it look like, the *Neurospora*?

IK: Yeah, so *Neurospora* is sort of this, it actually has this like, bright orange color which is sort of quite nice. But it's not very photogenic in a way, it looks like orange mold.

It doesn't produce a fruiting body, right?

IK: No. No.

[0:44:51]

So, how did you learn about the Fungal Olympics?

IK: I joined Twitter recently, mainly to sort of follow some science stuff and so on. And somehow I followed some people who were tweeting about this Fungal Olympics. And I thought, okay, that's something I have to participate. So because in Finland people take all kinds of sports super seriously. And every time somebody wins, even if it's something really obscure, it's always somehow a big thing. So I figured out that this is a great way because I obviously want to win the Fungal Olympics now. And you know, to promote science and all of this stuff. So I'm planning some press releases that I'm going to write for my university press office when this happens. We'll see.

[0:45:52]

Are you going to be entering the *Neurospora* in the contest?

IK: Yes. Yes. So we are actually doing some experiments now that are related a little bit to different things. So what I'm also interested in is in the genetics of sort of reaction norms or thermal performance curves. So that means when we measure the growth rate of the fungus in different temperatures, so you get this sort of curve that there is some optimum temperature, that the growth rate is the highest, and then when you go further from the optimum either to hot temperatures or cold temperatures the growth rate drops. So, we have a lot of strains in the lab, and we've been measuring a lot of strains now in different environments. But I sort of realized that this is an excellent opportunity to prepare for the Fungal Olympics because we have a lot of data now from different strains, and then I can just select some of my best strains for the competition.

[0:46:59]

Are you going for, I think there are different races. There's like the growth, speed, and then there's navigating the maze. Are you going to enter the *Neurospora* in all the categories, or do you think it'll perform better in some than in others?

IK: Yeah, I think the growth speed is going to be my main event. So that's what I'm sort of preparing for. But I guess I'll try all of the categories and see because for the other categories I don't really have such a great idea of how my strains are going to do.

And you said it's a filamentous fungi, right?

IK: Yeah, yeah.

So it can navigate possibly some of the maze obstacles and things like that?

IK: Sure. Sure.

Okay. So did you pick that one because that's your organism you study normally?

IK: Yeah.

[0:47:56]

So what do you think is going to be the biggest challenge for you in the Olympics?

IK: Well, I mean, it's probably going to be, that this is the first time that I'm participating and I don't really know so much about that. I guess there is sort of like, over confidence because I'm pretty convinced that I can beat quite good strengths, at least for the speed race. But of course there are probably people participating who are like, fungal experts and then they might, you know, know to pick a particular species or something like this that does really well.

[0:48:35]

Well, it's a good way to sort of test out an aspect maybe that you haven't studied of your particular organism.

IK: Yeah, and if this year doesn't work then at least next year I can sort of prepare and do some breeding. Because I have a lot of these strains, and I'm then going to make some crosses. I would like to breed more athletic fungal strengths.

So are you going to develop a training program for your fungus?

Yeah, exactly. Like, have this training montage in the lab. You know, like *Eye of the Tiger* is playing and all this stuff.

[0:49:17]

That wraps up episode 15 of Fungi Town. Thanks to Dr. Daniel Irimia, Derreck Carter-House, Jesús Peña, Dr. Jason Sty-ch, and Dr. Ilkka Kronholm for sharing their stories about the Fungal Olympics. I'll be checking in with them again after the competition to get their feedback. I'll also be talking to another round of contestants in the near future. So keep your ears open for those upcoming episodes. Special thanks to Rowen Cannon for providing the show's transcriptions. They make my editing process SO much easier.

[0:49:53]
Fungi Town is written, edited, and produced by me - Jen Parrilli and hosted by Podbean. The theme song is by local Athens band Shehehe. You can find all of their awesome songs on their BandCamp page at Shehehe.bandcamp.com. Episodes of Fungi Town are released about every other week. Be sure to subscribe so you don't miss the next episode, where we talk about something great in the Great Lakes. You can join the conversation and share your fungi photos with Fungi Town on Facebook, Instagram, and Twitter @fungitownpod. Now you can explore the lighter side of Fungi Town on YouTube, where you'll find my attempt at cooking with corn smut, unboxing videos of cool fungi-related toys and taste-testing of fungi products. If you like this podcast, please subscribe and leave me a review on iTunes. This goes a long way toward helping more people find their way to Fungi Town.Thanks for listening!"