

Science AMA Series: I'm Elodie Ghedin, talking parasitology/virology. AMA!

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Hi Elodie, thanks for doing an AMA!

This may not fall within the scope of your research, but I'm fascinated with the idea that pathogens or bacteria may influence human behaviour.

For example, I recall reading a theory that the parasitic toxoplasmosis may influence behaviour in some infected people. From a quick scan of Wikipedia:

This latent state of infection has recently been associated with numerous disease burdens, neural alterations, and subtle gender-dependent behavioral changes in immunocompetent humans.

I've also heard that the bacteria in our guts can influence our moods and behaviour.

So, is there any truth to these claims? Do you have any other examples of micro-organisms etc influencing the way we behave?

[Davidddddd](#)

The microbiome is thought to have a very important effect on our mood and behaviour because the gut has a very large number of nerve endings....that's why it is often referred to as the "second brain". So there is research being done on how nutrition can affect our gut microbiome which in turn can affect our behavior. This is all very new and likely to lead to some interesting discoveries in the near future

I'm an NYU student and I attended a WINS lecture you gave last fall semester (note I'm not a woman, I just thought your research was cool) and it was awesome! Still have my notes from it.

Anyways, how have you utilized computational methods in your laboratory! I'm really interested in the intersect between computer science and biology.

[uditmodi](#)

I'm glad you liked the WINS lecture :) We use computational methods every single day and I couldn't do any of my work if it wasn't for bioinformatics tools and many computational methods. Here's an example from my flu work: we obtain nasal swabs from people with flu; we isolate the RNA and amplify by PCR the virus genomes from each of the samples; these samples are each barcoded using specific tags so that we can pool all the samples together to sequence the mix of about 100 samples. We get

millions of pieces of sequences that we then need to map back to virus genomes, assemble and analyze. No human could do this by hand or eye. All computers. And the tools are pretty sophisticated as it is easy to make mistakes when you try to reconstruct genomes out of the jigsaw puzzle that is the sequence data.

Thanks for doing this AMA,

What are your thoughts on parasitic immunotherapy to modulate autoimmune diseases?

Do you think [LF](#) is an eradicable disease?

Merck and GSK don't see a lot of love on Reddit, could you explain a bit the donations of ivermectin and mectizan?

[PHealthy](#)

Now here's a fascinating field. There were some interesting advancements a few years ago on using *Trichuris suis* (pig whipworm) eggs to control inflammation in inflammatory bowel disease. Parasitic worms secrete molecules and proteins that have immunomodulatory effects, a.k.a. they can downregulate or upregulate the immune response. When they downregulate the immune response, it's a bit like wearing an invisibility cloak where they basically prevent the host from recognizing them as invaders. So the hypothesis is that you could leverage that to control inflammation. *Trichuris suis* will live for a little while in the human intestinal tract but will eventually be cleared (in about 2 weeks). During those 2 weeks, though, the worms are secreting their immunomodulators and can exert a pretty powerful effect. Ideally, you would want to isolate the molecule (or molecules) that the worms secrete so that you could develop a therapy that doesn't require ingesting live worms. There is still research being done on discovering new immunomodulators from worms but not much funding in this because it is considered high risk -- in the sense that the research may not lead to the isolation or identification of a specific molecule. It could be that you need a mix for it to work (worms can secrete more than 200 proteins and hundreds of other molecules).

What is your favorite/most interesting parasite or virus?

[Jpf123](#)

Parasitic worms are way up there on my "favorites" list because of how they can hide in their hosts for years. They secrete molecules that can control how their hosts "see" them. If we could harness this capability by isolating molecules that are good immunomodulators, we could develop a whole new set of therapeutics against certain diseases (like autoimmune diseases). With colleagues we are using the genomic information from some of these worms to try to identify such candidates (we call this panning for molecular gold).

Hello! I have some questions about susceptibility to, resistance to, and prevention of pinworms. One of the groups I work with is currently experiencing a huge outbreak so your AMA comes at a critical time.

Story time: I'm in a profession that has large amounts of people in multiple groups going to the field and essentially camping for anywhere from 3 days to 3 weeks. We are in the middle of a 3 week session right now and we're packing things up early because one of the groups has had an outbreak of pinworms. 5 days ago they had 10 cases. New infections have been occurring at an exponential rate, with yesterday's tally coming in at roughly 50 new pinworms infections, totalling over 160 people. Increased field sanitation resources have been ineffective. The infected group have been socially

quarantined, and are now coming down with ringworm and some bizarre vomiting flu like disease.

Questions:

- Does pinworms infection cause increased susceptibility to other infections? If so, how?
- Are there any pinworm preventatives/remedies that can be commonly found in a central US forest?
- Is there any genetic basis for pinworm susceptibility/resistance?
- Does nicotine use kill or resist pinworms? Most of my co-workers smoke or dip and there is a belief that nicotine in your bloodstream gives resistance to the pinworms, and/or that the dipping tobacco kills them on contact.

Sorry for the long post! I was so excited to see an AMA so relevant to my current and unique situation so I wanted to provide as much info as possible. Thanks for your time!

[Fragoutaboutit](#)

What I know of pinworms is that they are very contagious and so easily transmitted. The good news is that they are relatively innocuous and except for some itching they do not usually cause any other severe symptoms. I wouldn't think that they increase susceptibility to other infections. To my knowledge, no genetic basis has been found with increased susceptibility or resistance to pinworm. And I don't see any biological basis to a link with nicotine use.

Hi Elodie! Thank you for your time.

Are there viruses purely engineered by scientists? If so how dangerous are they? And could you describe the security protocols guarding them?

[balha108](#)

Certain types of viruses can easily be engineered in the lab but they usually follow a model of a virus that already exists, adding a few tweaks. Some of those modifications can be mutations associated with higher virulence, for example. I doubt a scientist could conceive of a whole new virus that nature hasn't already created! Highly pathogenic viruses are handled in labs with high biosafety levels to protect the lab technician as well as to prevent the escape of the virus. These labs are highly guarded. This type of work is also expensive and requires a specific set-up, so not something that can be done in your kitchen.

What do you think the long term effects are of utilizing viruses for targeted cancer therapies? It's a big industry right now. Is this the cancer miracle cure?

[otsego_chump](#)

I'm not sure. Certain viruses are being used because they are very specific in the types of cells they infect and are great "delivery" systems. A virus also can have a short "life" meaning that it can be cleared quickly. So I think it can be a powerful approach.

Parasites drive evolution of their host organisms.

The concept of infection adds a huge evolutionary pressure on the host organism to adapt.

Is there a limit to variety of genetic modification parasites can inflict on their hosts?

How is this 'mutation delta' compared to other entropy mixing mechanisms, like sex?

What are instances of 'hyper-infection' in which animal hosts are infected from or before birth? How do the hosts adapt? What is the trend for the specific organism?

Besides OUR 'active immune system', what are other active systems that other organisms use to fight parasites?

[emergent_properties](#)

The concept of parasites driving the evolution of their hosts is an interesting one. However, keep in mind that when we talk about the evolution of vertebrates, we are talking about a different time scale than when talking about the evolution of a virus. So in the short term, pathogens are not influencing the evolution of their hosts (i.e. they are most likely not leading to a new heritable trait), but they can influence a host response. For example, being exposed to bacteria and other microbes early on in childhood helps in the development of our immune system; this healthier immune system is however not a heritable trait. But throughout human evolution we have been exposed to a number of pathogens and have co-evolved with these such that we have genes that are important for responding to microbial invaders. It is thought that living in our sterile modern environments has cut us off from interacting with these regular invaders so that our immune system reacts inappropriately, leading to allergies and autoimmune diseases.

In your research, do you mostly work with other PhDs/laboratory researchers, or is there a lot of collaboration with other lines of work (MDs, public health workers, etc)?

I'm a recent grad looking at medical school (and potentially a dual degree program) in the near future, and I'm particularly interested in infectious disease, virology, and parasitology. While I'm much more interested in the clinical side of things, I'd also love to be involved in some research, so I would be interested to hear more about how different aspects of research and medicine come together in this field.

[TelemarketingEnigma](#)

I work with a whole set of people depending on the projects. I have projects right now where we work with clinicians who provide clinical samples and data, laboratory researchers who analyze the samples and sequence the genomes, and computational biologists who perform the analyses to link it all with the clinical information. We all meet, discuss data and try to figure out what is going on as a team. I have had medical students work in my lab on specific research projects. I like how they have a more "applied" view of what the work is about, while the PhD's tend to be focused primarily on the biology. So you can do research in infectious disease that is very much in line with your more clinical interests. Have you looked at the MD/PhD or MD/MPH programs?

Currently, there is an article posted in this sub regarding the link between our internal biological clock and when are bodies are most susceptible to virus's. In your research, have you ever noticed a link between the two?

[Chris538](#)

I haven't noticed a link but I haven't looked for it either (I just saw the article in Proceedings of the National Academy of Sciences and it is very interesting). The problem in looking for this link in humans is determining exactly when a person gets infected: symptoms can take from 2 days to a week when

talking about viruses that cause acute infections (like influenza or dengue). So unless you have a controlled experiment where you specifically expose people at a specific time of the day, it would be very difficult to determine. However, it would be worth trying to do this by epidemiological surveys. For example, indicate the time of the day when an infected person comes into contact with others. I could see doing this in a school or office setting for example.

How big a problem is subclinical infections with vira or parasites?

[Hells88](#)

My guess would be that subclinical infections are highly prevalent and I wish we studied them more systematically to better understand what role asymptomatic individuals play in epidemics. If we could quantify this we could add onto transmission models and make more robust predictions.

Hey thanks so much for doing this AMA!

So with Rio 2016 and the Zika virus..How big of a threat is Zika really? What kind of work is going on to find an actual cure? What's the kind of infrastructure in which a virus like this thrives? Also does it affect human performance? Is there a real risk of dissemination when athletes and spectators return home after the games?

[tqbopper](#)

Great questions. There is a lot we don't know about Zika. Although it was first discovered something like 60 years, it was considered a virus that led to only mild infections in humans. But, as you know, we are now seeing disturbing epidemiology linking Zika to neurological disorders. In the majority of people, it will be a mild or asymptomatic infection. But that's not reassuring when you are pregnant and fear for the health of your baby. As for athletes getting infected: the incubation period is about a week, and symptoms can be fever, and general malaise; so in theory it could indeed impact performance. There is now increased funding to develop a vaccine - just last week President Obama diverted some research funding to address zika specifically. There is also more work being done (although not enough funding) on pathogenesis to understand why the virus infects the tissues it infects, and how we could control these infections. With Rio 2016 there is a real risk of further dissemination around the world, although it is now already found in many parts of the world (wherever the right mosquito species can transmit it).

Do you think public health and systems biology will continue to converge? What new technological advances in biology do you think will effect global health most in the next ten years?

[numbersloth](#)

Yes, I definitely think those 2 fields are converging although it can sometimes be difficult to see the overlap. Public Health deals with populations while systems biology is the interaction of biological components that make up an individual. However, as we gain more knowledge on the biology of a system, we will be able to extrapolate to overall health, and eventually to population health (I hope this makes sense). As for new technological advances that will make the greatest impact, I am not sure.

How do you feel about our current situation as a global community when it comes to the ever encroaching post-antibiotic era? Do you feel that there could be more being done to prevent this. And as someone in that field itself is there any way that you feel you could help fight that possibility?

[ConstipatedUnicorn](#)

There could definitely be more done to address the very real public health problem that is antibiotic resistance. The over prescription and overuse of antibiotics has led to a disastrous rise in antibiotic resistance such that we have a dwindling arsenal to target certain bacterial pathogens. We need to decrease unnecessary use for one, but also increase research (and that means increasing funding for research) into finding new antibiotics or novel methods to eradicate certain pathogens.