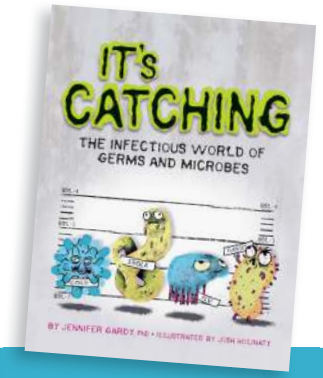
MEET THE DISEASE DETECTIVE

A Conversation with Author and Microbiologist Jennifer Gardy, PhD



AUTHOR Q&A

JENNIFER GARDY, PhD, is a scientist and science communicator. As a senior scientist at British Columbia's Centre for Disease Control, she sequences, assembles, and analyzes genetic information to understand how outbreaks of infectious disease begin and spread.

As a science communicator, Gardy is often found on TV and radio talking about germs and diseases. She has hosted a science documentary series as well as multiple episodes of *The Nature of Things* on CBC Television, is a regular guest host on Discovery Channel Canada's *Daily Planet*, and often appears on CTV's *The Social*. Gardy has also written and blogged for *The Globe and Mail* and runs a series of science communication workshops. *It's Catching* is her first book for children. She lives in Vancouver, British Columbia.

Q: Most people think of germs as being gross and something they'd rather avoid. What sparked your interest in working with germs and infectious diseases?

A: I've always been fascinated by health and disease, even as a little tyke. I had a series of books describing great scientists, and my favourite by far was the volume about Louis Pasteur, one of the giants of microbiology. That interest never waned, and as a teenager I saw the movie *Outbreak*, which really piqued my curiosity. I started reading everything I could get my hands on about infectious diseases — books like *The Coming Plague* (Laurie Garrett) and *The Demon in the Freezer* (Richard Preston) — and I realized then that being a disease detective and tracking new and deadly germs was what I wanted to do with my life.

Q: We often hear that germs are everywhere, but what does this really mean? How many microbes are out there?

A: Microbes really are everywhere — they're in us, they're on us, and they're around us in every environment on Earth. If you counted one microbe per second, it would take you over 3 million years just to count the ones living in your body. And if you added up ALL the microbes in the world, they'd weigh 500 billion metric tons — more than all the people, plants, and animals on our planet together!

Q: What do you think is people's greatest misconception about microbes?

A: Microbes often get a bad rap because people confuse "microbe" with "germ." All germs are microbes, but only a teeny-tiny fraction of microbes are germs — microbes that can cause disease. Most microbes are the friendly, useful sort, like the gut bacteria that help us digest our food, releasing important nutrients, or the environmental microbes that can digest pollutants. Microbes are really important in industry too — if you look at a pizza, the dough wouldn't rise without the help of yeast, the pepperoni's unique flavour is the result of curing the meat with the help of microbes, and those mushroom slices, those ARE microbes: they're the fruiting bodies of microscopic fungi.

Q: This year, we're hearing about a new strain of bird flu that could cause a similar pandemic to H1N1 in 2009. Why does this keep happening?

A: Germs are clever and they know that in order to survive, they have to keep infecting people, which means they're constantly having to outwit our various defense mechanisms, like vaccines and antibiotics. Influenza is an especially crafty germ — it mutates quickly, which allows it to try on new disguises in an effort to get around our flu shots. It's also unique because the flu virus that infects humans can also infect pigs and birds, which each have their own types of flus. If a human flu and a pig flu are in the same pig at the same time, they can share bits of their DNA with each other in a process we call recombination, and what emerges is a new strain of flu that is part human and part pig. We humans won't have ever seen this new virus before and don't have immunity to it, so it can spread very rapidly through

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a population.

Q: Why is it important for kids to understand the basics about germs?

A: We're at a new point in our scientific understanding of disease: we are just starting to appreciate the incredibly important role that our microbiome — all the microbes that live in and on our own body — plays when it comes to our health. Keeping our own microbial flora healthy and happy is going to be a big part of staying fit and healthy in the future, so it's important for kids to appreciate the microbes that live inside us and the role they play in our bodies' ecosystems. We're also facing the very serious problem of antibiotic resistance, and I think it's important for kids to learn about microbial and antibiotic stewardship. They're the scientists of tomorrow who will be developing our next generation of treatments, and they need to understand what we're dealing with and why our past attempts haven't worked.

Q: What germ do you think is most overhyped in popular culture and media? Which needs more hype?

A: Ebola definitely hogs the limelight — it's got a reputation as a deadly supergerm that's a definite death sentence. In reality, while definitely nasty, Ebola isn't as big a threat as people might think. The way it cripples its host (causing the host to hemorrhage blood) makes the virus instantly recognizable, which means it can't spread very far. Outbreaks are usually limited to a few cases in one community. On the other hand, I think people underestimate how serious the flu can be, especially for vulnerable segments of our population such as infants, the elderly, and the immunocompromised. Flu kills thousands of people in Canada each year, and it doesn't have to — the flu shot can be very effective at preventing infection. Healthy adults often say they don't need a shot because they're not worried about getting sick, but if they're in contact with young kids or older folks, I'd strongly urge them to reconsider — not to protect themselves, but to keep their more vulnerable companions safe.

Q: Do you have any microbiologist secrets to avoid getting sick — and to avoid getting others sick?

A: Wash your hands, wash your hands, wash your hands! By far that is the single best thing you can do to stop yourself from getting sick or spreading germs to others. And just regular soap and water is fine — there's no benefit to using antibacterial soaps or washes. If you haven't got access to soap, an alcohol-based hand sanitizer will also work. Practicing food safety is key too, and it can help protect you from some of the bugs lurking in and on foods from chicken to lettuce to berries. Wash your fruits and veggies, clean your cutting boards thoroughly between uses, keep raw meats away from other things in your grocery bags and in your fridge, cook meats to the right temperature, and keep things like raw meat and eggs cool until right before use.

Q: Is it true that there's no cure for the common cold? Is there anything we can do to fight it?

A: There's no cure, but there sure are a lot of home remedies to help relieve the symptoms. Scientists have evaluated a few of these in formal scientific studies, and it turns out that in some cases, Mom really does know best. Chicken soup, for example, can be effective — the hot, steamy liquid sends off vapours that can relieve congestion. Curling up in a warm bed helps too — there's evidence that suggests that keeping your body warm helps your immune system to act more effectively.

Q: Your science communication work focuses on getting the general public and young people excited about science. What fuels your passion?

A: I've always loved sharing the joy of science with others, from talking about my own research with my scientific colleagues and seeing them be excited by what I'm doing to talking about more general scientific concepts to the public, young and old alike — the people who, ultimately, fund our research and whom we serve. That spark in someone's eyes when they suddenly understand the science behind an everyday phenomenon is a real motivator for me. I'm always happy to take science questions from folks via email or over the internet. I think that science as a whole could do a little better at interacting with the public, and I try to set a good example for my colleagues by being accessible and being proactive through media appearances.

Q: Are microbes actually smarter (or better adapted) than us?

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A: Microbes aren't necessarily smarter, but one advantage they do have over us is evolution and the rapid time scale it happens over. When you look at humankind, different populations have evolved different adaptations that allow them to thrive in specific environments — for example, people living at high mountain altitudes, like in Tibet, use oxygen in a very different way than people living at sea level. In humans, evolutionary adaptation occurs over tens of thousands of years because we only reproduce every 25 years or so. With bacteria, which reproduce every 20 minutes, evolution works on a much faster time scale, and we can actually see organisms adapting to new conditions, like the emergence of antibiotic resistance, within a few years after a new drug is first introduced. Because we can see this unfolding in real time, it gives the impression that microbes are smarter than us, but really they're just fast. Very, very fast.

Q: Vaccines have become controversial, and you've got to admit the concept of getting germs injected into you is a bit unsettling! How do vaccines work? Should we worry?

A: Vaccines are extremely safe, and the only thing that people should be worried about — which is actually happening right now — is what happens when a sizeable number of people in a society stop vaccinating their children. Diseases that were rampant in children until the 1960s and 1970s and then went away — diseases like measles and whooping cough — are now coming back because not enough of our population is being immunized. And these aren't trivial infections like a cold — these can cause death and lasting damage. The generation of parents that are not vaccinating grew up in that perfect period where it looked like we had eliminated most of these childhood disease, and they simply don't know what it's like for a neighbourhood to be gripped by an outbreak of something like mumps.

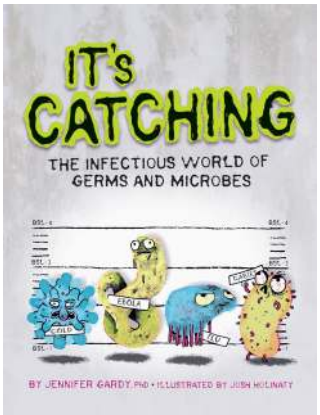
One of the big misconceptions about vaccines is that you're being injected with a little bit of something that could actually cause disease. With very few exceptions, this isn't true — most vaccines contain bits of a virus or bacterium, but not the actual organism. Those bits alone could never cause disease, but they do serve as a sort of "Wanted" poster for your immune system — you're showing your immune system what a particular germ might look like by exposing it to specific parts of the germ ("Be on the lookout for a suspect with brown eyes, blonde hair, and a big mole on his nose"), so that when it ultimately encounters that bug in the real world, it recognizes it ("I've seen that hair and those eyes and that mole before…") and mounts a response.

Q: What would a microbe-free world look like? Would we want it?

A: If all the microbes were suddenly removed from Earth, I'd be willing to bet that ecosystems would start failing within days, and humans wouldn't make it much longer past that. It would be a bigger disaster than a giant asteroid taking out a big chunk of our planet.

Q: A lot of the discoveries described in *It's Catching* — like penicillin and agar gel for petri dishes — happened serendipitously, by accident, or in unexpected places. Is this true of scientific discovery in general?

A: Serendipity plays a huge role in science, and although a lot of discoveries come about through a long-term program of research and investigation, pretty much every scientist out there has at least one *AHA!* moment — maybe it was a totally unexpected discovery that was instantly important, or maybe it was accidentally stumbling upon something that led to a new path of research that paid off many years later, but we all have at least one of those moments — if we're lucky!



IT'S CATCHING
The Infectious World of Germs and Microbes

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