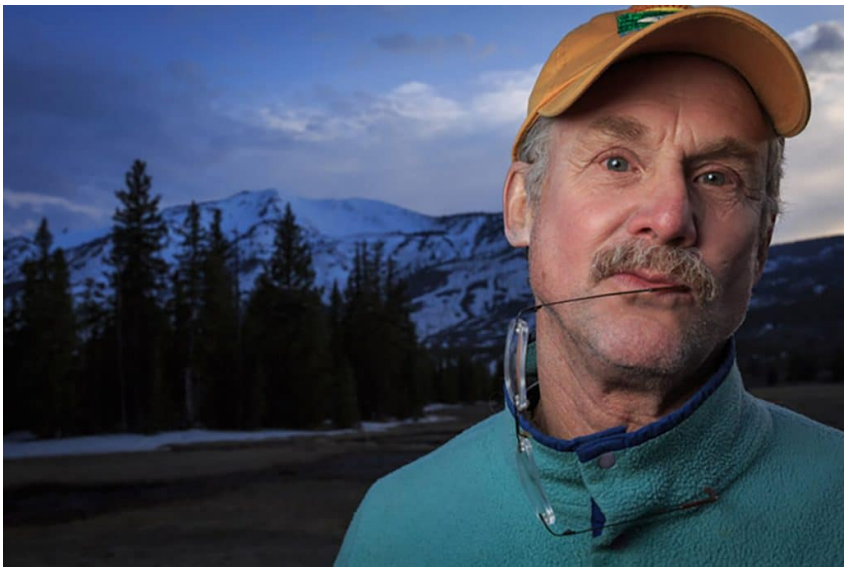
How it feels to predict a pandemic: Interview with David Quammen, author of Spillover

By Dan Drollette Jr, June 11, 2020



Portrait of David Quammen in the backcountry of Yellowstone National Park. Image courtesy of Ronan Donovan

In 2012, author David Quammen wrote a book, *Spillover: Animal Infections and the Next Human Pandemic*, that was the result of five years of research on scientists who were looking into the possibility of another Ebola-type disease emerging. The consensus: There would indeed be a new disease, likely from the coronavirus family, coming out of a bat, and it would likely emerge in or around a wet market in China.

But what was not predictable was how unprepared we would be. In this interview, the *Bulletin*'s Dan Drollette Jr talks with the author, who lives in Bozeman, Montana, about what drew him to this topic, the nature of new viruses, why more are expected to emerge, and what makes some viruses more likely to infect humans than others. Quammen also talks a little about his next book (still untitled, but about the coronavirus). He cautions against being overly optimistic about the development of a vaccine, saying the coronavirus that causes COVID-19 will likely be around in some form for generations: "This virus is never going to be gone."

(Editor's note: This interview has been condensed and edited for length and clarity.)

Dan Drollette Jr: Sounds like you're busy lately.

Quammen: Yes. Although I've been housebound lately, like many people. I don't know when I can travel to research a new book for the publisher,

Dan Drollette Jr

Dan Drollette is the deputy editor of the *Bulletin of the Atomic Scientists*. He is a science writer/editor and foreign correspondent who has filed stories from every continent excep...

on coronavirus. But I'll be knocking on doors in Wuhan, China, as soon as they let me in.

Drollette: Are you nervous about traveling to the epidemic's epicenter?

Quammen: Not really. I'm respectful of the risks of this virus. But that's nothing new—when researching *Spillover*, I climbed into bat caves in southern China.

And I've followed dangerous emerging viruses long enough that while I'm cognizant of the dangers, I know it's just a matter of calculating risk: It's not an emotionally charged topic.

The way I see it, I've been home in Bozeman, and haven't left the house for two months. So I've had the luxury of reducing my risk to 0.0 for the last two months. Soon I'll start doing higher-risk things.

Drollette: There does seem to be a degree of alarm and paranoia about viruses. Why is that?

Quammen: Viruses are spooky to people. Unlike bacteria, you can't see them, even with a [standard] microscope. We didn't even know viruses actually existed until the 1930s, although the word was bandied about. The whole 1918 influenza pandemic was caused by a virus—a hypothetical agent no one could see, isolate, or identify. How spooky was that? Because there were lots of secondary infections from bacteria,

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and we didn't have antibiotics then.

So 1918 must have been a peculiar, frightening event: This invisible thing comes to town, kills off members of your family, and then leaves. It's like the angel of death in the Book of Exodus.

Drollette: So you think a lot of the fear is because it's invisible, mysterious…

Quammen: Yes. And there is a debate as to whether viruses are even alive—an interesting thought.

Coincidentally, I'm reading up on that angle now, for a *National Geographic* piece on the evolutionary history of viruses.

It may be that all these oddities combine to make people particularly scared. Plus, in recent decades, there have been some very alarmist, in my opinion, treatments of emerging viruses, like *The Hot Zone*. Ebola in particular—the virus that book deals with—has been given the full-on, Grand Guignol-type of dramatic sensationalism.

Ebola is one of a very dangerous group of closely related viruses; I think five are now classified within that Ebola genus. People heard, "This virus causes bodies to melt down and bleed out." And then a few cases got into the United States, and people got scared.

Drollette: I wanted to circle back to something:

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You said there's a theory that viruses might not even be alive?

Quammen: The idea is that a virus is just a chunk of genetic code packaged in a protein capsule—essentially just a blueprint that takes over your cells and reprograms them to replicate itself, then multiplies and spreads to your other cells, and then maybe spreads from you to somebody else.

An interesting twist on this concept is the "virocell," advanced by a fellow named Jean-Michel Claverie and another scientist named Patrick Forterre. They say: "Don't look at these virus particles as the virus. Think of them as just the gametes." In other words, a virus particle is nothing more than the equivalent of a sperm cell from a human being—it's not a full-on human being. The real virus living identity comes about when it's in one of your cells and has successfully hijacked the cell to make copies of itself—*that's* the living virus, or virocell.

The product of that process are these particles that carry the infective genome to other cells. Think of those as the gametes. And then when they get into another cell, then you have a sort of fertilized egg cell—what biologists call a zygote.

Drollette: Do you have a background in biology?

Quammen: I've been a science writer for about

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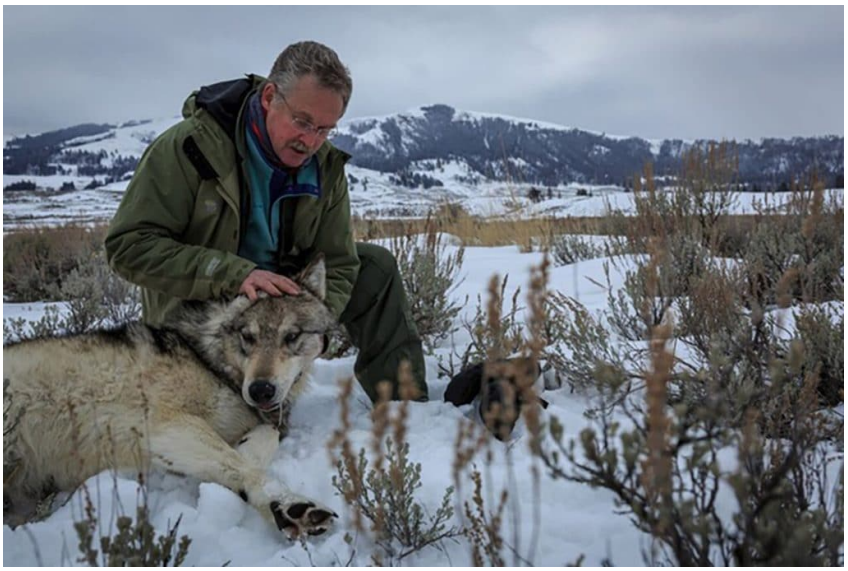
35 years, which has been sort of on-the-job training.

But I actually started out as a novelist, doing my graduate work on William Faulkner—and gradually turned into a nonfiction writer with an interest in science.



David Quammen, while accompanying a wolf collaring and tracking operation in Yellowstone National Park for a National Geographic article. Image courtesy of Ronan Donovan

Drollette: How did you get interested in ecology and evolutionary biology?

Quammen: When I moved to Montana back in ’73, I thought, “I’m done with ivy-covered universities” and wanted to make a living as a writer. I was interested in the natural world and started taking some non-degree courses in zoology at the University of Montana. But that was zoology.

And then in 1982, my first wife began a master’s

degree in ecology and evolutionary biology at the University of Arizona. So I went with her to Tucson. And she would come home from class and start talking about this guy named Robert MacArthur, who was like the James Dean of theoretical ecology—extraordinary youthful promise, and premature death.

That interested me. And then by coincidence I discovered that he and E.O. Wilson had written a book called *The Theory of Island Biogeography*.

I was working as a columnist for *Outside Magazine* at the time, and while researching a column on it, I thought: "I wonder if anybody has written anything for popular magazines about evolution and extinction on islands?"

And it felt like discovering Mammoth Cave. I went in through this little hole and came out into this big magnificent chamber with these amazing paintings on the walls. And that was my encounter with island biogeography. And that became the book *The Song of the Dodo*, which took me eight years to do.

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I then moved into the more micro level, with *Spillover*.

Drollette: Speaking of evolution, my understanding is that the overwhelming majority of viruses never evolve to skip from one host species to another. So, how did some make that jump?

Quammen: Some viruses just happen to be what is called “pre-adapted” to make that leap from animals to humans.

In the case of coronaviruses, you have a naturally occurring bat virus that happens to have on its exterior these knobs called spike proteins. Each spike acts like a grappling hook, allowing it to grab hold of a target cell and maybe get in.

As it turns out, the cells this spike protein is best at grabbing onto are in a species called the horseshoe bat. These particular bats have what are called ACE-2 receptors on the outsides of their cells. Because of these particular receptors, they’re very prone to being attacked by these particular viruses.

And it just happened that we humans have these ACE-2 receptors in our own cells, in our respiratory tracts. So, by coincidence, this naturally occurring virus of bats was quite qualified from the get-go to attack human cells.

That’s why the virus was able to spread to humans. It had that capacity before it ever hit the first human, apparently. And therefore this thing

was pre-adapted to become a human virus—probably.

Drollette: For the virus, making that leap across species—zoonosis—must have been like Columbus discovering the Americas: Suddenly, there's a whole new world open to conquest.

Quammen: Yes, although I would compare it more to the first group of a dozen finches blown offshore from the mainland of South America to the Galapagos Islands. This little subpopulation of finches is blown westward by a storm that carries them 500 miles out to sea, and they land on these volcanic islands that don't contain any predators or any competitors. So they've got it all to themselves. And they can flourish there and maybe diversify into a number of different kinds of finches. It's ecological colonization followed by evolutionary adaptations. And that's what happens with viruses.

Drollette: Did anyone expect this?

Quammen: Yes. For 15 years, scientists have said: "Watch out for coronaviruses; they could be very dangerous." And for five years, Chinese scientist Zhengli Shi at Wuhan Institute of Virology has been warning us to watch out for the coronaviruses found in Chinese bats; SARS is a coronavirus, and it came out of Chinese bats in 2003. That was very dangerous to humans, but it didn't transmit as readily as this one does. But

Shi and her group saw a virus very similar to it in bats in a cave in Yunnan Province and published a paper in 2017 saying, “Watch out for these particular coronaviruses in these horseshoe bats. They necessitate the highest preparedness.” That was three years ago.

Drollette: Did the virus go directly from bats to humans? Or from bats to pangolins or civets to humans?

Quammen: It could have infected one or more intermediary species. There’s some important new work coming from a group of Chinese and Western scientists, who noticed how close this disease is to some pangolin coronaviruses. It’s also close to some other bat coronaviruses, not just the ones that Zhengli Shi found, but new ones. It’s a jigsaw puzzle of a virus.

Drollette: Which leads to my next question: A lot of blame is laid on Chinese wet markets. What exactly is a wet market?

Quammen: A couple of days ago, a Chinese friend said: “What you guys call wet markets are the same places my father used to take me to buy fresh vegetables.” And that’s important to remember.

But a wet market like the Huanan Wholesale Seafood market in Wuhan, which is associated with the beginning of all this, is where you buy

fresh vegetables. And you can buy seafood there—alive and dead—as well as chickens, ducks, and frogs.

So a wet market is a fresh food market that sometimes includes wild animals.

And those wild animals have two possible sources. One is the captive breeding of wild species under controlled hygienic circumstances, and the other is capturing animals from the wild, bringing them in live in cages.

Drollette: Bushmeat?

Quammen: Yes, although the term bushmeat has a certain stigma to it. Generally, when Africans do this, we call it bushmeat; when Chinese people do it, we call it wet markets. And when we do it here in Montana, we just call it game—and there's no stigma.

of a nice farmer's market in upstate New York with cheeses, candles, fresh vegetables, organic chickens, turkeys, and whatnot.

Then add to it some some raccoons and skunks, in cages.

And maybe the cage with the skunks is stacked

on top of a cage with organic chickens, so that skunk urine rains down on the chickens. Now, would you want to buy those chickens?

Drollette: Are we stigmatizing Asians for having these kinds of conditions in their markets?

Quammen: To some degree, yes. But capturing wild animals and bringing them, alive, to markets where all these other forms of food are sold is extremely dangerous. So the world is right to say: "Look, China, you are a sovereign nation, we're not going to stigmatize you culturally. But for the love of God, get a handle on that trade because it's dangerous."

Drollette: Some people claim that buying and selling wild animals in a market like this is an ancient Chinese tradition.

Quammen: A Chinese friend of mine, Wufei Yu, wrote an op-ed for the *New York Times*, "Revenge of the Pangolins," saying that this is not hallowed tradition. In fact, he found that ancient Chinese texts said: "Don't eat pangolins, you could get sick. Pangolins are not food, don't eat them."

So, eating pangolin is not a revered ancient tradition in China. It's more part of a newfound, middle-class vogue for conspicuous consumption. As in "I've got a business dinner, so I'm going to take my clients out to a restaurant where I'll impress them by serving monkey brains

or pangolin."

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Drollette: That ties in to your own *Times* op-ed: "We invade tropical forests and other wild landscapes, which harbor so many species of animals and plants. And within those creatures, so many viruses. We cut the trees, we kill the animals or cage them and send them to markets. We disrupt ecosystems and we shake viruses loose from their natural hosts. When that happens, they need a new host. Often, we are it."

Quammen: That sums it up. There are more zoonoses because we're disrupting the environment.

But it's important to acknowledge that we humans have always killed and eaten wild animals for the last 200,000 years. Therefore we have always presumably come into contact with the many viruses carried by wild animals. So that's an old thing.

What's new is that there's 7.8 billion of us on this planet—four times the number of humans at the time of the 1918 influenza. And we have quadrupled the speed we travel around the

planet; we have quadrupled the size of some of our cities. So there are a lot more of us large-bodied vertebrate animals, living in dense aggregations, moving fluidly from one place to another.

We're the world's greatest target for a virus—a great ecosystem for them to colonize. So when a virus does get into a human and finds it can replicate and transmit to the next human, that virus has opened the door to vast opportunity. And what's new is the scale.

Consequently, in the last 60 years, there's been this drumbeat of what are called spillovers, where new viruses get into humans and cause trouble: Machupo, or Bolivian hemorrhagic fever, in 1959. Marburg, 1967, coming out of monkeys that were sent to Marburg, Germany for research purposes. Ebola first emerging in 1976, MERS in 2012, Zika in 2015, and this. So it's happening more, with greater consequences, and greater potential to spread worldwide.

Drollette: Does climate change factor in? Are we seeing warm-weather diseases now appearing in former temperate zones?

Quammen: To some degree. Dengue, yellow fever, and malaria are moving north because the mosquitoes that carry them are moving north. That's the most obvious effect of climate change.

And forest fragmentation plays a part. We have more Lyme Disease in New England now because instead of having an area completely covered with deciduous forest, it's broken up into hedgerows, lawns, and little patches of forest carrying lots of white-footed mice—which carry the ticks that cause Lyme Disease. There's a lot more of these infested mice because there are not as many predators such as owls, hawks, foxes, or weasels to keep the population down. So the mouse population increases, and your kid is more likely to get Lyme Disease when he goes out to play in the yard.

Drollette: If these trends continued, do you think we'll see more zoonoses?

Quammen: Yes. And a greater chance that each spillover will turn into an outbreak, each outbreak into an epidemic, and each epidemic into a pandemic. But there are things that we can do to stop that.

Drollette: What should we have done to contain this coronavirus outbreak?

Quammen: Everything about this outbreak was predictable, to me and to the scientists I was listening to, 10 years ago.

New virus coming out of an animal, yes, predictable.

Animal was a bat, yes, predictable.

Virus is a coronavirus, yes, predictable.

Happens in or around a wet market in China, yes, predictable.

What was not predictable was how completely unprepared we would be.

A virus starts getting into people and spreading from airport to airport—but we have no diagnostic kits that work. We have no platform vaccine that can be modified to become a vaccine for this coronavirus. We have no public health emergency capacity. We have no integrated national plan in this country. We have nothing except the lying president who stands up there worrying about his poll numbers every day, with a noble man named Tony Fauci forced to stand next to him. Who's been in that job for 30 years, and he's the greatest tightrope walker since the Wallendas.

All of that has been very surprising to me, how utterly unprepared we have been. Trump says, "Well, we're going to close our borders to Chinese people flying in. No more Chinese people are going to be able to fly in." Great. Great. That's going to solve this problem. Not.

And then he does nothing after that. I don't want to make this purely political, Trump is just a symptom. But for various reasons, the United States has been cataclysmically unprepared.

Drollette: When do you think this pandemic will be over?

Quammen: On NPR this morning, somebody made the casual statement that, "In six months or a year maybe this virus will be gone."

This virus is not going to be gone. This virus is never going to be gone.

We have friends who have children and grandchildren, and their great-grandchildren will be vaccinated against this virus.

Drollette: So you don't trust optimistic projections about a coronavirus vaccine?

Quammen: The medical doctor Paul Offit is a skeptic on the instant vaccine thing. He's been telling everyone to slow down on expectations for a vaccine, and stop celebrating Moderna or Gilead or whoever has got the prototype vaccine. He says there's a ridiculous amount of hoopla for a tiny sample size at a very preliminary stage. Vaccine development takes a long time, and a lot of luck. And then vaccine manufacturing at scale takes another truckload of time…

It's important to remember that responsibility for this includes everybody; it's not just the fault of some Chinese people who eat pangolins or bats. Nor is it the fault of African people who eat bushmeat that sometimes includes primates. This is the responsibility of all 7.8 billion of us,

because we are all consumers of food, resources, and energy. Each of the choices that we make about what we're going to eat, wear, or buy draws on these wild ecosystems.

So does how much we choose to travel, and how many children we have—if we choose to have children at all. All these decisions put pressure on the natural world to varying degrees and cause viruses to come in contact with humans. Even using a cell phone has an environmental cost; we are consuming the minerals—such as coltan—that make the capacitors inside these things work.

Coltan is mined in just a few places around the world, such as the eastern part of the Democratic Republic of Congo, not far from their biggest national parks and nature reserves. We consumers require miners to go in there and get that coltan for us; and what are they going to eat but bushmeat.

So by owning a cell phone, you're asking a miner to go into places where coltan is mined, and there's a good chance that one of those places is in the eastern Democratic Republic of Congo, and the guy mining that coltan for you is probably eating bats, monkeys, elephants, or lowland gorillas.

So, by being a consumer, you share responsibility for this whole problem.