Hello and welcome to Columbia Public Health Now, a podcast devoted to exploring the local and global implications of public health challenges in our communities. This Spring, we are focusing the series on the novel coronavirus and its impact on our world and our health. I am your host Maria Andriella O'Brien and I thank you for listening.

Have you heard about how COVID-19 was a science experiment gone wrong? Or was it a military weapon let loose on the world? All these rumors and more have been circulating almost as fast as the coronavirus in the past few months. With so much of our energy focused on surviving this pandemic, perhaps we’d be forgiven for wondering who cares where this came from, let’s focus our resources on a cure or a vaccine. Well, we’d be forgiven... except that confirming the origins of COVID-19 doesn’t just help us to better understand this particular virus – but it helps to protect us for the long-term. Zoonotic diseases are diseases that jump from animals to humans. Numerous human diseases began in animals – like anthrax, Ebola, or malaria. The more we understand about any given outbreak – which animals did it come from, were there more than one species involved – helps prepare us for the next virus that jumps from the animal world into ours.

Spoiler alert for this episode. We’re about to hear a lot about bats for the next 20 minutes, and very little about mad scientists who cooked up a coronavirus nightmare in their labs.

Our guest today is Dr. Simon Anthony, an assistant professor of epidemiology in the Center for Infection and Immunity at Columbia’s Mailman School of Public Health. For the past decade or so, he’s spent a fair bit of time with bats in a number of countries in Latin America, Africa and other parts of the globe. Dr. Anthony seems to have a very healthy respect for the important role bats play within nature’s eco-systems. Even as he compiles the evidence that links them to this devastating outbreak. You were a member of Predict, a global program to detect viruses in animal hosts with pandemic potential, can you tell me a little bit about your work with that group?

DR. SIMON ANTHONY

Predict program which started 10 years ago now, was established by the U.S. Agency for International Development, or USAID, and it was really the pioneering vision of Doctor Dennis Carroll and others at USAID, who recognized there was a real need to try to move upstream of these merging pandemic events and try and improve global capacity against zoonotic viruses before they emerge rather than after. I often like to think about it in terms of the military, constantly training and being prepared, and no one would expect to only call on the military and start that process after a threat has been made—that’s an ongoing capacity and ongoing process. And so, when it comes to emerging diseases, what we mean by capacity is really everything from training wildlife biologists how to catch and serve, a wildlife training, lab staff,
equipping labs with the equipment that they need, and even working with governments and building sort of one health infrastructure at the government level. So, really capacity means everything that’s involved in trying to be, and needing to be, more prepared against emerging diseases.

MARIA ANDRIELLA O’BRIEN

You’ve been working on coronaviruses for some time now. What did we know about coronaviruses prior to this COVID-19 outbreak?

DR. SIMON ANTHONY

Well, actually I work with Predict—we’ve learned quite a bit about coronaviruses, and in particular, coronaviruses in wildlife. One of the things that we realized was that bats are major reservoirs for coronaviruses. When we do our global surveys and we look in bats and rodents and all sorts of other different types of animals, we found that bats by far were really prominent hosts for coronaviruses. We also found that certain types of coronaviruses tend to be associated with certain types of bats. For example, the SARS-like coronaviruses that we’re dealing with right now seem to be associated with certain types of bats that are found in South and Southeast Asia, and pockets of Africa. And that’s important because if we know that, then we can start to make very broad, high-level predictions about where we expect to find certain types of coronaviruses based on where we find their hosts. So, if you’re interested in where SARS-like viruses are likely to be, you would of course go and look where the bats are that we now know carry those types of viruses. The third thing that we came to realize was that not all coronaviruses have equal potential to infect humans. We found that there are viruses circulating in bats that are closely related to MERS, that are closely related to SARS, but these viruses don’t seem to have the same ability to infect people, at least not in their current form. So, being closely related to a significant pathogen doesn’t automatically mean that you’re going to act in the same way. There may be slight differences that mean a closely related virus may not be able to infect a person. It’s probably the case that the vast majority of viruses that are out there actually don’t have that ability and that’s why although these zoonotic and emerging events can be very, very impactful, they’re still relatively rare.

Another thing that we learned was that these coronaviruses actually can evolve and adapt quickly. In other words, a virus that is actually not zoonotic today, might very well be so tomorrow. And that’s because of this process called recombination that coronaviruses use and this is an evolutionary mechanism that allows these viruses to swap out certain parts of their genome. And if they swap out particular parts, for example those that control the proteins that allow viruses to get into cells, then that could have very significant impacts on the types of cells that they’re able to infect, and even the types of hosts that they’re able to get into. So, for example, it could change a coronavirus’ ability to infect bats, cats, humans, any number of
different species and is one of the reasons that coronaviruses are able to actually jump and emerge in new hosts.

It’s also important to consider the way they evolve, and study these mechanisms that essentially allow a virus to change its properties and its ability to infect humans. Lastly, the thing that we were able to do in conducting these global surveys was come up with estimates of the total unknown coronaviruses that may be out there. We were able to look at the average number of coronaviruses that we found in any one given bat species and then simply extrapolate that to all of the known bats that exist and we came up with a number of about 3,700 coronaviruses that are predicted to exist. That means that a vast majority of coronaviruses have yet to be discovered. There’s a lot of really important work that still has to happen where we go and we survey wildlife and we look for those viruses and we try to figure out which ones have the ability to infect people, which ones don’t, what are the reasons underlying that that helps us to of course make rapid assessments of the risk that they pose, and as I just mentioned, how do these viruses evolve and essentially acquire the ability to become potentially zoonotic.

MARIA ANDRIELLA O’BRIEN

Can you tell us something about the wet markets in China where the virus was believed to have originated and how it jumped from animal to human?

DR. SIMON ANTHONY

The process by which that initial event happens—that spillover, could happen in all sorts of different ways. With SARS-Coronavirus-1 back in 2003, that was associated with a wet market, and at the time it was thought that there was a spillover event from you know, a bat that went into a civet and into a person. Whether or not that’s exactly what happened, we still don’t really know and even years later new evidence comes out to help clarify that situation. But what that shows is that wet markets are one potential interface by which people can be exposed to these viruses. With the current pandemic, I think the jury is still out in terms of whether the wet markets were truly involved in the emergence of this virus. In part because there were cases prior to the link with the wet market, also because some of the species that we think are important like bats were not reported to be at the wet market. So, I think in this case it’s a little less clear as to whether the wet market was truly involved. But what your question does bring up is the importance to try and understand what the interface was. Even for any virus it could emerge by multiple pathways and so studies, epidemiologic studies, as well as ecological studies and virology studies are all important to try and figure out how that process actually happens.
EPISODE 10: BATS, LABS, AND RUMORED ORIGINS

MARIA ANDRIELLA O’BRIEN

This leads to—there have been constant rumors about the possibility of this being a manmade virus and it just seems to be very persistent out there. Is there any truth to this, or why do you think that it even seems to be the rumor that won’t die?

DR. SIMON ANTHONY

I think that when we don’t understand something, especially something as significant as this, you reach for all possible explanations. I think that because we put so much trust in our scientists and our governments I think it leads many to think there must be things that the public are simply not being told about where this virus came from. So, I think it’s understandable; it’s also, to be honest, important that we consider any and all hypotheses for where the virus may have come from. It does us no service to not consider all possible sources. But that the simplest explanation is generally the one that is truest also. We have seen several coronaviruses spillover from animals into people—this is number seven, remember. We know that these viruses are very prevalent in bats and in particular, the SARS-like or what we call Sarbeco Viruses, we know that bats are the primary reservoirs of that. So, to me the simplest explanation is that the virus originated from a bat—how it got from a bat into a person is still an unknown question—whether it went directly or whether it went by an intermediate host, of course we still don’t know that. But the simplest explanation is that this is just a natural very, very unfortunate event. I also think it’s important to remember that this is not the only virus for which we struggle with where it comes from. Ebola is another really good example of that. We’ve been dealing with outbreaks of Ebola virus for more than 40 years and we still don’t know what the natural reservoir of Ebola is. There’s a lot of circumstantial evidence pointing to bats in exactly the same way that it’s pointing to bats for this virus, but we haven’t nailed down exactly which species it is and that means that we have no ability to make any useful predictions about where outbreaks of Ebola might occur or when they might occur and that makes mitigating, or intervening, to try and stop those events extremely difficult.

MARIA ANDRIELLA O’BRIEN

So, you’ve spoken a great deal about bats today and part of me is thinking, well, how do we control the bat population, and part of me is thinking in the extreme—how much do we really need bats if we have to worry about Ebola and other diseases? But I’m sure it’s not that simple and something that you probably have an opinion on.
EPISODE 10: BATS, LABS, AND RUMORED ORIGINS

DR. SIMON ANTHONY

I appreciate you actually bringing that up because it’s a really important point. Bats are absolutely critical for our ecosystems. Many of the foods and even the drinks that we enjoy depend on bats and they serve as very important pollinators around the world. They are hugely important insectivores so they control insect populations. If we took away bats, then we would simply dramatically increase the amount of insect-transmitted disease that we see. So, I think it is so important for people to recognize that yes, bats do carry viruses with the potential for zoonotic spillover, but that we can live safely with bats. We must not go in and cull bats—let’s also remember that they are absolutely critical for our ecosystem.

MARIA ANDRIELLA O’BRIEN

Returning to some of your previous comments about the mutations of the coronavirus in that they tend to be relatively quicker in time compared to some other. I’m curious about your definition of “quicker”—is that a season, a year, a decade? And then related to that question would be maybe there could be mutations that would be beneficial to us at this stage or mutations that could cause more problems, and if you have any thoughts on the different routes that the mutations might take?

DR. SIMON ANTHONY

Yeah, so when I say that coronaviruses have the ability to adapt quickly that doesn’t necessarily tell us anything about how frequently that actually occurs. The process of recombination relies on two different coronaviruses co-infecting the same cell at the same time. And when that happens, you can have exchange of parts of the genome where essentially it can sort of grab hold of one part of the virus and sort of swap out—let’s say that the surface proteins that control cell entry. And so, you end up with very significant changes. So, when I say rapid, I mean in the case of one round of infection, one co-infection, that virus can actually change quite dramatically in terms of its genome and potentially the types of species that it could then go on to infect. But we really don’t know enough yet about how often that occurs. Relevant to the other question that you mentioned about adaptations, we know that some viruses, when they jump into new species, they sort of acquire new adaptations to improve replication in that new species. We haven’t really seen any conclusive evidence that that is happening here; it certainly does happen, but we haven’t yet seen any evidence for example, with the current virus that it’s adapted to be more pathogenic, or more transmissible, or anything like that.
MARIA ANDRIELLA O’BRIEN

And I think that’s something people have been talking about because they look to the flu pandemic of 1918 and the second wave being much more serious because of the evolution, or the changes to the virus. But as a previous person who we had interviewed on a podcast pointed out to us—it’s two very different types of viruses so you can’t really extrapolate one thing from the other.

DR. SIMON ANTHONY

Right. Exactly. I think that, you know, we look to the events that have preceded this [23:00] or to other viruses, to sort of help us guide what could happen, but I think it’s, as you rightly point, these are very different situations.

MARIA ANDRIELLA O’BRIEN

So, in a situation with so many unknowns about the virus, what would be the most useful information for scientists to confirm about the coronavirus that would help us during this pandemic?

DR. SIMON ANTHONY

For me, because of the work that I do in terms of trying to be more prepared for these things in the first place, I think that a big question is, where did this virus come from? Goes back to the question you were asking earlier. I, as well as many of my colleagues in the community, are pretty sure that this virus has a bat origin but which bat? And how did it get from a bat into a person? Was it transmitted directly or was it via an intermediary host, as has happened previously? I think another important question is what does the virus, or did the virus, look like in that original bat host? Is it essentially the same virus? Obviously now that it’s in humans, it is starting to acquire mutations, it is starting to change so it now won’t look exactly the same but is there any evidence that this virus actually adapted in an intermediary host that then allowed it to infect people? Or is the virus that’s circulating in bats already equipped with the potential to jump straight into a person, even if that didn’t necessarily happen? And that’s important because it might tell us something about the likelihood of it happening again. If the virus circulating in bats, the original, the precursor, the ancestor of this pandemic virus—if that virus has everything it needs to jump straight from a bat into a person, then there is the possibility that this could happen again. If, however, the virus jumped from a bat into an intermediary host, and some change happened there, and then the virus jumped into a person, then I think the likelihood of this happening again must be lower. And then, unrelated to the questions of the
origin or the source of the pandemic, one important question right now that everyone is thinking about is whether or not exposure leads to protective immunity. That’s really critical and if so, for how long that immunity lasts. That, of course, is important when it comes to thinking about medical interventions like vaccines, but also for modelling future transmission and how the pandemic—may unfold as we move forward. That is another very important question that we need to address.

MARIA ANDRIELLA O’BRIEN

From your vantage point of working in a lab, and I’m sure communicating with colleagues probably around the globe about this, do you get a sense that enough resources are out there supporting the science that’s needed for this outbreak?

DR. SIMON ANTHONY

Both the U.S. government, and in fact governments around the world have all directed massive resources now towards dealing with this pandemic, and I think they should all be acknowledged for that. I do think that it’s important not to forget about preparing for the next one. I know we’re in the middle of dealing with this one and so it’s sort of like one thing at a time for sure, I would certainly agree with that. But I think what this shows, or what this reminds us, because again this is not the first time, this pandemic really underscores that zoonotic viruses have the ability to impact every single one of us. Not only do they have huge public health impacts as we are seeing, but only do they have massive economic impacts as we are seeing, but they are impacting every corner of our lives right now and for really significant periods of time. I hope that what this does is lead to continued investment in much the way that I mentioned right at the beginning—that we need to constantly be preparing and constantly be building the foundational knowledge base and capacity to respond and mitigate these unfortunate events in the future.

MARIA ANDRIELLA O’BRIEN

Columbia Public Health Now is a production of the Columbia Mailman School of Public Health in New York City. Visit: mailman.columbia.edu/podcast for more information on our show. Share your comments on social media with #PublicHealthNow. I am your host, Maria Andriella O’Brien and thank you for listening.