

## Virus Speciesism

Five years had passed since I last sat in a classroom as a student. During that time I was a Smithsonian Fellow at the National Zoo for two years as their first woman veterinarian and then I joined the faculty of the newly formed College of Veterinary Medicine at the University of Tennessee. Part of my responsibilities at UT was to provide veterinary coverage at the Knoxville Zoo. I elected to go to graduate school because my patients too often were dying from opportunistic infections or infections that should not have been fatal. I wanted to understand why.

That is how I found myself sitting in a classroom as a student at Johns Hopkins School of Hygiene and Public Health. The class was Pathogenesis and Epidemiology of Human Viral Diseases. I liked the class because it allowed me to compare what I knew about animal viruses with their human counterparts relative to pathogenesis. Today's class was about respiratory diseases. I knew from veterinary school that rhinoviruses were responsible for the common cold in people, but I did not know that coronaviruses also were responsible. One of my classmates spoke out and questioned why we needed to know anything about coronaviruses since they did not cause serious disease problems in people. Clearly, he had never been laid up for several weeks with a massive head cold. The second part of his comment was that they only were a big issue for animals. All eyes turned to me. I *was* the only veterinarian in the class. I just shrugged and said, "Just wait."

I was not prescient. I was irritated. Students who questioned why they needed to know something and asked if the material was going to be on the exam have always annoyed me. Who knows what you might need to know when faced with patients as diverse as mine are or when trying to understand pathogenesis of a novel virus.

The year was 1982 and acquired immunodeficiency syndrome (AIDS) was a clinical reality without a known cause. It would be another year before human immunodeficiency virus (HIV) was isolated and classified as a lentivirus in the family Retroviridae. Lentiviral diseases had been recognized for centuries in animals, long before viruses were known to exist. I was excited because my thesis work was with lentiviruses of sheep and goats. Admittedly, we did not see compromised immune systems in small ruminants. We were studying them because in addition to pneumonia and arthritis they caused demyelination. The lab group hypothesized these viruses provided a good animal model for multiple sclerosis.

All the hype that HIV was such a unique virus irritated me yet again - unique that a lentivirus was found in people, but not the first lentivirus to cause disease. My medical colleagues told me HIV was unique because it targeted T cells, not monocytes and macrophages like in sheep, goats, and horses, which was true until feline immunodeficiency virus (FIV) was discovered in 1987. And I won't even go into all the different retroviruses of non-human primates that were being tried on for size as compatible animal models to study AIDS. No one could have fathomed at the time that chimpanzees were the reservoir for HIV.

During my time as a graduate student, I went to a lot of seminars on AIDS and HIV, many of them focused on vaccine development. I made the comment once that no one was going to make a successful vaccine against HIV. Again all eyes turned, this time to censure me.

"Suzanne, HIV is not the same as the sheep and goat lentiviruses."

“True, but all lentiviruses employ strategies to evade the immune system and in some instances, antibodies might actually be detrimental.”

I faced a sea of exasperated faces, so just to placate everyone I quickly conceded that a vaccine might be developed if a totally new and novel approach was tried, but I could not leave it there. I also said at least AIDS was preventable. Wow, this went over worse than no vaccine possible. I honestly did not appreciate at the time that humans do not seem able to comply with preventive measures to protect their lives and the lives of others. I knew there was a reason I became a veterinarian.

The year is now 2021, and we still do not have a good vaccine for HIV and we are currently pinning our hopes on several vaccines for SARS-CoV-2. And yes, mRNA vaccines are a novel approach not even imagined in the 1980s, but I remain skeptical. Vaccines for animal coronaviruses are no way as sophisticated as the mRNA vaccines for humans, but long-lasting immunity is not as big a concern because frankly, food animals are processed for consumption before waning immunity becomes a concern. Our companion animals are not even vaccinated.

In general, pigs, chickens, cats, and dogs show mild respiratory or enteric signs once coronavirus is endemic. Naive populations experience higher morbidities and mortalities, and there are always those pesky mutations and recombination events that can increase virulence with undesirable outcomes. I am over-simplifying, but this is not a scientific treatise. What is exciting for me as a veterinarian is to learn that feline infectious peritonitis (FIP), a disease caused by a coronavirus that was 100% fatal in cats when I graduated from veterinary school, can now be treated successfully with combined anti-viral therapies similar and sometime identical to the drugs used to treat COVID patients. As with HIV, SARS-CoV-2 will probably be easier to treat than prevent.

So I will say it again that COVID-19 like HIV can in large measure be prevented. It is certainly a lot easier to put on a face mask than a condom, although neither measure is infallible. I probably should not go further with this because what is a public health issue has unfortunately become politicized. Animals are so much easier. I regret that schools of public health eliminated hygiene from their names as they attempted to be more relevant on a global scale. Hygiene has been and will always be important to human and animal health, and the assumption that everyone understands and practices this is false.

A veterinary colleague told me she sent information on animal coronaviruses to an MD she knew in public health, and he was surprised to learn there were so many. What I wonder is whether he looked at the similarities for possible insights on how to manage SARS-CoV-2. As a veterinarian who has treated an incredible array of species, I have always looked for commonalities first and then differences. Humans to me are just another primate, which admittedly I am not licensed to treat, but frankly are not that special compared to all the other primates I have treated.

I think Dr. Fauci has been paying attention to the veterinary literature. Early in the pandemic, he tried to downplay effective herd immunity through vaccination anytime soon and stated that he thought it would be 8-9 years before we returned to what we knew as normal. That seems like a pretty good estimate for how long it will take for this virus to become endemic in the human population. Meanwhile, I expect to wear a mask in public for the remainder of my life no matter what happens.

“Respectfully submitted for your consideration,”

Suzanne Kennedy-Stoskopf, DVM, PhD