



# NATIONAL VETERINARY LABORATORY

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## NEWSLETTER

### Science Has Not Found A Cure For Stupidity<sup>©</sup>

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Fall 2020

Vol. 19, Number 4

#### In This Issue:

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, is still with us! Yes, science has not found a preventative vaccine, therapy, or cure for stupidity!<sup>1</sup> Neither shutdowns nor masks are the tools for some takeover of our country! We have not also cornered the market on stupidity as Europe is now in the midst of an aggressive second wave. These statements were adapted from the ProMED\* moderators, but are exactly the feelings of Dr. Hardy. As veterinary scientists, we know what is scientifically correct and what protocols are necessary for preventing and treating diseases. I have been at numerous scientific meetings with Dr. Tony Fauci, Director of the NIAID and Dr. Robert Redfield, Director of the CDC, and know them to be top-notch, respected scientists who have tried to guide us out of this COVID-19 pandemic nightmare. In this Newsletter, I will update the human and animal components of the pandemic and highlight some new hope.

\*ProMED is an email program of the Society for Infectious Diseases <<http://www.promedmail.org>>

#### Human Pandemic:

As of this writing:

#### Worldometer for the Pandemic

October 10<sup>th</sup>: Worldwide data

Total infections: 37,459,161

Total deaths: 1,077,458

New infections today: 360,006

October 10<sup>th</sup>: United States data

Total infections: 7,768,629

Total deaths: 214,844

These data clearly indicate that the pandemic is NOT under control and is unlikely to “disappear magically.” Tragically, the United States has the most cases and deaths of any country in the world. We continue to argue amongst ourselves about the need for the universal use of face masks, social distancing and whether the pandemic “is real!” Since January of this year, this has caused us to obtain partial control, only to see politics disrupt our accomplishment and enable a second wave of the disease. The Sturgis motorcycle event in South Dakota this summer lead to a major spike in cases (12.5%) in that county. An economic analysis estimated the public health cost of the event was 12.2 BILLION dollars. This was enough to pay each attendee \$26,553.64 NOT TO ATTEND.<sup>2</sup> Similarly, an Oklahoma City political rally caused a major spike in cases there and the death of a politician.

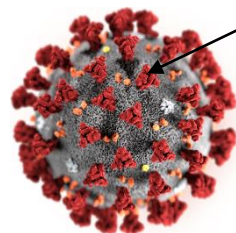
There has been an unprecedented amount of money spent on this disease, from epidemiological studies, clinical observations, therapy and vaccine studies, to even psychological studies of COVID-19. We have learned a lot, that even survivors of the disease are not fully “in the clear,” as many possible long-term effects are possible due to the pathogenesis of SARS-CoV-2, the viral cause of COVID-19.

#### Pathogenesis: Similar for SARS-CoV-2 (COVID-19), FIPV and Bartonella.

Several pathogens, bacterial and viral, have similar pathogenic mechanisms. Basically, they cause disease by stimulating the infected animal’s immune system to react too vigorously against the pathogen which damages vital tissues. In doing so, severe, often life-threatening consequences occur.

**SARS-CoV-2** coronavirus infects cells via the attachment of the viral spike (S) protein to the ACE2 (angiotensin-converting enzyme-2) cell receptor which is present on lung cells and various other cells in the body. **S Protein**

Severe COVID-19 disease, often causes a cytokine storm which results in widespread damage in many tissues- the heart, lungs, blood vessels, nervous tissue and others.



CDC/ Alissa Eckert, MS; Dan Higgins, MAM

**FCoV** the feline coronavirus has 2 pathotypes, FECV the non-pathogenic feline enteric coronavirus that mutates in cats to produce the feline infectious peritonitis virus FIPV, the virus which causes the immune mediated fatal FIP disease.<sup>3</sup> There is now effective anti-viral therapy for FIPV, FCoV and FIP.

**Bartonella** are Gram-negative bacilli that possess pili that penetrate RBCs and endothelial cells. The ability to adhere to the membranes of RBCs and endothelial cells, leads to the wide and varied tissue pathogenesis observed in cats, dogs and people. Pili and a protein called deformin are probably responsible for the sticky properties. The wide tissue specificity of *Bartonella* is due to the adhesion to endothelial cells which are the constituents of capillaries. Thus all 3 pathogens cause inflammatory lesions in numerous tissues, which for *Bartonella*, some critics thought was too much to attribute to this agent.

#### COVID-19 Pandemic Continues:

Science has learned a lot since our last COVID “Science Matters” Summer Newsletter. Excellent studies have found that: CDC recommendations do work to reduce the infection rates and COVID-19 cases, that masks are very effective in controlling the spread, that although children are less affected, they can have severe disease (multi-system inflammatory disease) and die. Unexpected long-term effects in adults and children can occur in the heart (myocarditis), brain (Parkinson’s Disease, brain fog, confusion), blood vessels (strokes), kidneys, and long-lasting pulmonary dysfunction.<sup>4</sup> In addition, disquieting second infections have been found and verified indicating that not all recovered patients are immune.<sup>5</sup> A new route of spread has been discovered when it was found that people begin shedding the virus in their feces 2 to 3 days after infection, long before symptoms occur, if they notice any symptoms at all. This leads to the finding that testing wastewater or sewage can be an effective way to spot early infections and detect hot spots before cases occur.<sup>6</sup> One study found infections transmitted vertically via aerosols from bathroom vent stacks to 9 people in 3 families in a high-rise apartment building in China.<sup>7</sup>

#### COVID-19 Therapy:

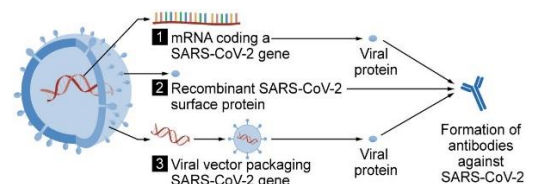
There is as yet no curative therapy for the infection or the disease. The following have been tried:

- Remdesivir-** (GS-5734) nucleotide analogue
- Monoclonal antibody cocktail** anti-S protein
- Steroids-** to dampen the cytokine storm
- Antibiotics-** prevent bacterial pneumonia
- Immunostimulant-** BCG TB vaccine

#### SARS-CoV-2 (COVID-19) Vaccine:

##### Vaccine platforms as of September 2020

- Non-replicating viral vector
- RNA-based
- Inactivated virus
- Protein subunit
- DNA-based
- Replicating viral vector
- Virus-like particle
- Live attenuated virus



Source: GAO. | GAO-20-583SP

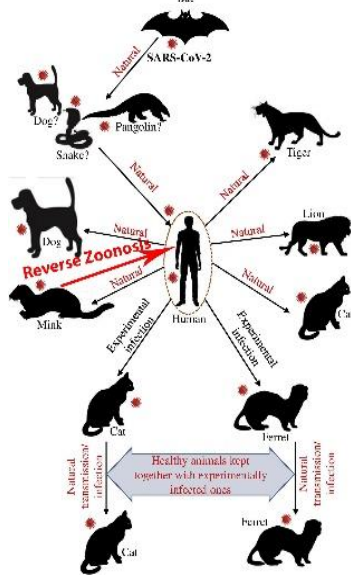
By U.S. Government Accountability Office from Washington, DC, United States - Figure 2. Vaccine candidates use different mechanisms, such as those shown above, to prompt the body to produce antibodies against SARS-CoV-2. Public Domain, <https://commons.wikimedia.org/w/index.php?curid=90807433>

David Quammen's book *Spillover, Animal Infections and the Next Pandemic*, 2012 W.W. Norton & Co., is about the origins, in animals, of most of our new zoonotic diseases. Approximately 80% of human pathogens have originated from animals as zoonotic infections. He detailed the occurrences of Ebola, Marburg, SARS, avian and swine influenzas, Lyme disease, and of course AIDS.

### Animals:

Coronaviruses have been long recognized as causing pathological conditions in veterinary medicine. They infect a range of animals such as bats, cats, dogs, pigs, cattle, horses, camels, rodents, birds, Beluga whales, seals, and other wildlife. Most animal coronaviruses infect the intestinal tract and are transmitted by the fecal-oral route. Animals are important in the pandemic story as the virus originated in an as yet to be discovered animal source in nature. Most evidence points to a bat coronavirus infecting an intermediate host which then infected a person in China.

A growing number of animals appear to be susceptible to the SARS-CoV-2 virus and thus may act as a new expanded reservoir for zoonotic transmission.<sup>8</sup> Most alarmingly are cats and dogs who share the environment of hundreds of million of people around the world. Even though there is no evidence to date for these species of reverse zoonosis transmission (anthropozoonotic), it certainly seems reasonable to conclude that it is possible.



**Origin, Host Range & Reverse Zoonosis of SARS-CoV-2**  
<https://doi.org/10.1016/j.jmii.2020.06.006>  
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The figure above illustrates the origin and susceptible species to SARS-CoV-2 and the example (red arrow) of reverse zoonosis (anthropozoonosis) from zoonotically-infected mink to humans in the Netherlands.<sup>9-11</sup> This is frightening in that it illustrates that any susceptible animal may become an additional animal reservoir and source for continuation of this pandemic or through viral mutations within the mink, or other animals, to create viruses with different pathogenic properties.

### Feline Coronaviruses:

One of my early publications was an etiological study of experimental transmission of FIP

where 38 of 51 cats developed FIP, via inoculation or orally, from filtrates of disease tissues.<sup>12</sup> Little did we know, 49 years later, how significant the viral cause of FIP might be regarding this pandemic. As mentioned in the pathogenesis section, there are 2 pathotypes of feline coronaviruses (FCoVs), FECV the non-pathogenic enteric coronavirus that mutates in cats to produce the feline infectious peritonitis virus FIPV which causes the immune mediated fatal disease, feline infectious peritonitis (FIP). Several important papers report the successful therapy for feline FCoV where the virus has been eliminated and the advanced FIP disease has been cured. Hopefully, these compounds may be able to be used in the treatment of SARS-CoV-2 infected humans.

The enteric FECV is very prevalent in multiple cat households and catteries and is very contagious via fecal-oral transmission. Nearly all cats in these household become infected with FECV. This virus mutates into the non-contagious FIPV in very few cats which causes fatal FIP disease.

### FIP Coronavirus Therapy:

Several very encouraging studies of coronavirus therapy have been reported in cats. Coronavirus 3CLpro and papain-like protease process viral polyproteins into functional viral structural proteins to enable the virus to replicate. The first study found inhibitors that target 3C-like protease (3CLpro) had broad inhibitory effects against animal coronaviruses. Using the GC376 pro inhibitor in cats with **experimental FIP**, started at the clinical stage that would lead to death, caused rapid reversal of signs, reduced viral titers and there was no active infection after 14-20 days of therapy. The cats remained normal for 8 months of observation.<sup>13</sup> A similar study was done on 20 **pet cats** with naturally occurring FIP with similar results in 19 of the cats.<sup>14</sup> The last study was able to clear FCoV fecal shedding in chronically infected healthy carrier cats before any FIPV mutants appeared.<sup>15</sup> This is a very important preventive study which can markedly reduce the occurrence of FIP in cats.

The natural extension of these animal studies was to study the effects of these compounds on a human coronavirus, the SARS-CoV-2. One study found that GC373, and its parent GC376, are potent inhibitors, in the nanomolar range, of the SARS-CoV-2 replication in cell cultures, and thus warrants clinical trials in people.<sup>16</sup>

### SARS-CoV-2 Infection of Animals:

#### Experimental Infection (Susceptibility):

Cats, dogs, ferrets, mink, hamsters, rhesus macaques, tree shrews, grivets, cynomolgus macaques, common marmosets, rabbits, and fruit bats can be experimentally infected. Experimentally infected cats, ferrets, mink, tree shrews, and hamsters can transmit the virus.<sup>17</sup>

#### Naturally Infections:

There are continuing reports of animal (cats, dogs, mink, ferrets, 3 lions, 4 tigers, both at the Bronx Zoo, NY) SARS-CoV-2 infections from infected people around the world. As many as 1 million mink will have to be culled due to infection on farms in Denmark. As many as 8,000 mink have died, mostly older mink, from SARS-CoV-2 on 245 farms in Utah and 21

other states. The Netherlands has had the highest number of mink farms affected and have even had documented reverse zoonotic (anthropozoonotic) transmission from mink to humans.<sup>9-11</sup> Countries with SARS-CoV-2 transmission to animals include the United States, Russia, Japan, France, Belgium, United Kingdom, Denmark, Netherlands, and Hong Kong.

### Wildlife:

The Wildlife Health Specialist Group of the International Union for Conservation of Nature and the World Animal Health Organization have recently released guidelines to minimize the risk of SARS-CoV-2 transmission from people to free-ranging wild mammals.<sup>17</sup> Free-ranging wild mammals may also be susceptible to SARS-CoV-2 which may result in some becoming a reservoir of the virus which may kill susceptible species on the endangered-species list. Some taxonomic groups at moderate to high susceptibility are non-human primates, cervids, and cetaceans, bovids, antelopes, New World anteaters, and some rodents.

**Editorial: We, as a country, must act together to control this pandemic by adhering to the medical recommendations of experts. Our clients have done an excellent job at this. There is now hope that an FIP veterinary drug may be effective against SARS-CoV-2 in people.<sup>16</sup>**

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**SARS-CoV-2 & COVID-19 references can be obtained at: [www.nlm.nih.gov](http://www.nlm.nih.gov) National Veterinary Laboratory, Inc., 2020<sup>©</sup>**