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MĀNOA

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COVID-19 from the View of a Virologist:

Aloha! Like many of you, I am currently a Work From Home person. I want to say at the beginning that, in this day and age, all of us must work hard to keep **ourselves and our next-door neighbors healthy and our global neighbors healthy as well**. Any disease is potentially global now. Always remember that **viruses don't need visas** – they are free to come and go just about anywhere they want.

Background relevant to the current pandemic of COVID-19:

COVID-19 is a zoonotic viral disease – this is an infectious disease caused by a virus that spreads from a non-human species to humans – there are a number of viruses in nature with this capacity.

COVID-19 is causing a pandemic – i.e., a global outbreak of a disease that meets these criteria:

1. **a new virus in humans** which means we have no immunity to it;
2. **causes serious illness** which is reflected by significant morbidity (illness) & mortality (death); and
3. **spreads easily from person to person worldwide**.

Currently, there are **209 countries and territories** involved with **1,339,970 cases and 74,412 deaths**. This is definitely a pandemic.

Now, about the virus itself – **Coronaviruses** – corona means “**crown**” and these viruses are named after the solar corona, the bright crown-like ring of gases surrounding the sun that is visible during a **solar eclipse**. The virus looks like that because of the **S or Spike protein** which is the virus attachment protein that sticks out from the surface of the virus.

Viruses are very small and composed of a genome (RNA or DNA), proteins and, in some cases, fat (gained by certain viruses when exiting through the infected cell membrane). Two major features of a virus are (1) the virus cannot make more of itself unless it gets into living cells. After the virus enters the cell, it takes over the cellular machinery to produce proteins and nucleic acids needed for making new viruses - infected cells can then release thousands of viruses which go on to infect more cells. (2) the virus must manage to get from one host to the next (i.e. transmit to others), or it will die out.

A virologist would describe coronaviruses as **enveloped, single stranded, positive sense RNA viruses** – the most important word in that description for most folks is that it is **enveloped**, i.e., has a fat coat – and that is the reason to use **soap** when you wash your hands, because soap dissolves fat which can inactivate (i.e., kill) the virus. Also, use **warm water** because viruses do not like heat which also can denature the proteins, expose the genome and also inactivate the virus. Using **running water** dilutes anything that may be on your hands. So, washing your hands with warm soapy water and rinsing liberally is the way to go.

Coronaviruses as a class are **actually quite common in people and other animals**. Coronaviruses produce diseases in non-human species we regularly encounter like **pigs, cows, chickens, dogs, and**

cats. In humans, these viruses are **endemic (i.e., around all the time)** typically causing mild self-limiting respiratory disease – a cold. However, they are responsible for about **15-30% of respiratory infections** each year in people.

Nonetheless there are other coronaviruses in nature which are considered a significant health hazard. The major reservoir of these viruses in nature is **bats** – a research study in 20 countries testing over **19,000 bats and thousands of many others species** yielded over **100 different coronaviruses** and **98%** were found in **bats** belonging to 282 different bat species. The bats appear healthy which is common when a species is the **natural reservoir**. Even when experimentally infected, bats show no signs of disease. It is postulated that, when bats fly, their body temperature gets very high - like our body having a fever. Thus, an active bat's metabolism will boost its immune system and likely helps control these viruses.

4 types of coronaviruses exist in nature - alpha, beta, gamma & delta. **Alpha and beta coronaviruses** are the ones which produce disease in mammals.

COVID-19 is a member of the **beta coronaviruses** which also includes **SARS** (Severe Acute Respiratory Syndrome) and **MERS** (Middle East Respiratory Syndrome) – these are the **bad actors**. And they come from bats. Most of us aren't around bats so there is typically an **intermediate host** which gets infected from a bat and then transmits the virus to humans.

A little recent history: From **2002-03**, Asia was struggling with **SARS**, with palm civets and raccoon dogs being the potential source for humans in live animal markets. The origin of that virus was likely **Chinese horseshoe bats**. This virus did not cause a pandemic because it **didn't spread quickly enough** (i.e., transmit to others). However, its mortality rate was high - **9%**.

Then in **2012-14**, **MERS** (Middle East Respiratory Syndrome), a similar disease, appeared in Saudi Arabia with **2200 cases** and a **30-40% mortality rate**. Again, the rate of transmission was too slow to cause a pandemic. The intermediate host was **camels** with the reservoir host thought to be **Egyptian tomb bats**.

So, we have had recent **warnings about these viruses**.

Today we have **COVID-19** which likely emerged from bats as well and infected another species in the live animal markets. In those markets, many different species, including animals from the wild, are kept in cages sitting on top of each other – then slaughtered when they are purchased – while thousands of people walk through the markets. It is a cultural practice to keep live animals because then people know the meat is fresh – but this practice must stop. For example, **pangolins** are a possible intermediate host in the case of COVID-19 – a pangolin is a wild, endangered mammal – and everything about it says “don't eat me”, but the meat is considered a delicacy and the scales from it are used in Chinese medicine. Some are referring to this disease outbreak as the **Pangolin's Revenge**.

I always give this advice when I talk about influenza viruses and it applies to coronaviruses as well – **never ever go to live animal markets**. They are viral time bombs ready to explode at any moment.

What about the disease? The disease: many people don't have much problem with it, ranging from having no symptoms to a fever, cough, and fatigue; however, 20% are more seriously ill, characterized by shortness of breath – largely due to pneumonia, particularly in people in my age group – the seniors or kupuna who are likely to have co-morbidities (i.e., other diseases or conditions).

Why does that happen? COVID interacts well with certain receptors, specifically angiotensin-converting enzyme², which is common in the lungs. So, the virus replicates well in the respiratory epithelium reaching into the lungs. It is also thought to infect macrophages and dendritic cells which don't produce virus but may be important in inducing **pro-inflammatory cytokines** – which, in large amounts, can create a **cytokine storm** and cause a lot of damage to the lungs. In the 1918 flu epidemic which killed 40 million people, the cytokine storm was thought to be a major cause of deaths in young people.

How fast is it moving in the U.S.? On Feb. 3, 2020, in the U.S., there were **11 cases and no deaths**. Today, on April 6, 2020, there are **362,995 cases with 10,736 deaths**. Clearly, this virus spreads exceptionally well in humans. Unfortunately, there are no drugs or vaccines yet available to deal with this disease, so supportive care is all that can be offered to infected people.

Why is this virus hard to stop? A big issue is that, like with flu, people are **shedding virus when they are not showing symptoms** and feel fine – so screening has limited value, except for detecting those with fevers who should certainly be quarantined, along with anyone in contact with them. Also, how many of us see a physician because we have a cold? Not many of us do. Also, the virus can last on surfaces for several days and float in the air in droplets when someone coughs or sneezes for several hours – thereby increasing the likelihood of infecting others.

There is one major requirement in dealing with such viruses if you want to stop them: You need an **active surveillance system coupled with rapid diagnostic testing and quarantine**. While working with WHO (World Health Organization) on surveillance of influenza viruses, I learned the adage “**if you don't look for it, you don't see it and, if you don't see it, you don't prepare for it.**” Sadly, that is exactly what the U.S. did. The U.S. did not take the virus seriously from the very beginning, has conducted limited testing and failed to secure the **equipment** needed for patients and for **protection** of our medical personnel. I believe this virus gained a foothold early on because of that approach, so now we see the impact. Even now, we do need much more testing to really know where we are in this pandemic.

Because we don't know enough, we are left only with more **draconian measures to use – physical distancing and restricted travel with quarantines**. In Hawai'i right now, anyone who flies into our state will be quarantined for two weeks. Those of us who live here will also be quarantined if we travel to any of our other islands. As a tourist center, Hawai'i faces huge economic losses with unemployment estimated to grow from 2.7% to greater than 25% and, of course, businesses are failing during this time. Yet the only hope of not overloading the medical system is **restricting our contact with others**.

So, as individuals, **what can we do?** We can stay/work from home (whenever possible), limit contact with others, practice good hygiene (especially washing our hands), cleaning surfaces which are frequently touched and wear masks when we are out because it is clear that people without any symptoms can be infected and shedding virus. Individually, we should try to keep fit by exercising every day, sleeping 7-8 hours a night, eating nutritional foods, staying socially connected via phone, text, FaceTime, etc. and trying to reduce stress which can harm our immune system. Also, no one should be hoarding supplies that many folks need - particularly if required for our medical personnel and also for all of those folks working to meet our needs during this time, such as staffs for laboratories, groceries, restaurants, etc. Hoarding is definitely not showing aloha. People are scared and that is understandable, but we also **need to stay calm**. We also must step up to support our local businesses and nonprofits, as well as people who have lost their jobs, because they are really suffering.

Between **increased viral testing and the emerging antibody tests for COVID-19**, it is hoped that such information will help identify people who have recovered and hopefully are immune to reinfection, so they would likely be able to return to work. But we aren't there yet.

At this point, we simply have **not learned our lessons** about the power of microbes. This pandemic will pass but the cost in lives and livelihoods will be high. Hopefully we will learn our lessons this time and be better prepared for the next one, because sadly there will be a next one. On that note, I do like to remind folks what Ralph Waldo Emerson said:

**“The sun shines after every storm,
There is a solution to every problem,
and the soul’s highest duty is to be of good cheer.”**

Mahalo! Wishing you the best of health! With warm aloha - Virginia

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This message prepared by Chancellor Emeritus Hinshaw provides valuable insights for the general public and our JABSOM ohana. I am forwarding it as an important message to our JABSOM ohana.

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