# The International Wildlife Trade and Public Health

## Stemming the International Wildlife Trade: A long shot on behalf of public health

***Daddy: Olga has just been given a gorgeous parrot for her birthday: can I have one too?***

Photo by creativebin from Pexels

**A. Alonso Aguirre, D.V.M., M.S., Ph.D.**

Department of Environmental Science and Policy, George Mason University, Fairfax, VA 22030-4400, USA

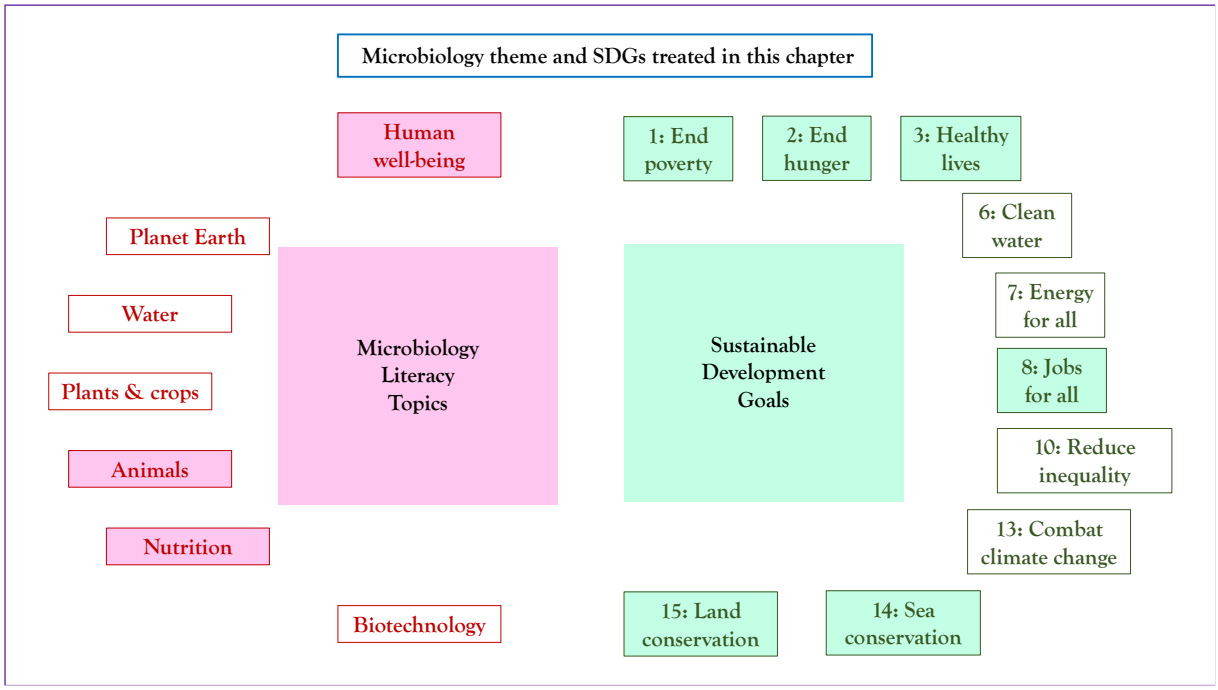
# International Wildlife Trade

## Storyline

The wildlife trade poses many threats to public health and biodiversity. It threatens species involved and poses a great risk as a driver of emerging infectious diseases. It opens new disease transmission pathways that could lead to epidemics and even pandemics like the one we are facing today with COVID-19. The types of wildlife trade, legal or illegal include the pet trade, bushmeat, and wet markets. Herein, I highlight the need to detect, document, and prevent spillover events from the wildlife trade. While compelling, the human health justification for protecting biodiversity is extremely anthropocentric. Now it's time to fill in the missing piece—how biodiversity and ecosystem services depend on us. This is the time to change our ways toward the environment. COVID19 is giving humanity a pause to think in new and creative ways to manage our world sustainably, wisely and with respect for the benefit, wellbeing and health of all species in the planet

## The Microbiology and Societal Context

*The microbiology:* infectious disease ecology; zoonoses; *And, peripherally for completeness of the storyline*: the business of wildlife trade and companion pets; bushmeat; wet markets. *Sustainability issues:* end poverty; end hunger; healthy lives; jobs for all; reduce/prevent extinctions of endangered species.



## International Wildlife Trade: the Microbiology

***1. Changing field of infectious disease ecology.*** The field of infectious disease ecology has undergone major changes since the early 1980s, when I was a master's student at Colorado State University. Due to my veterinary background, I was perplexed by the population dynamics course or the wildlife ecology course that described disease as a part of ecosystems and animal populations. At that time, the field of disease ecology was largely a documentation of epidemics or models assuming that diseases were just another part in the puzzle of carrying capacity and compensatory mortality of wild populations. The field has evolved dramatically in the past 30 years. In fact, almost any ecologist I know is working or would like to work on this field. And more than ever we need to connect ecology and health in unimaginable ways to acknowledge the dynamic phenomenon involving the ecology of the infectious agents, pathogenesis in the host, *reservoirs* and *vectors*, and the complex mechanisms that lead to the spread of disease across *species and ecosystem barriers* and understand why these 'spillover' from wildlife to humans or domestic animals and then eventually in some cases 'spillback'.

2. ***Global nature of environmental causes of infection and the need for transdisciplinary science.*** The environmental causes of health problems are complex, global, and poorly understood. Traditional approaches to the development of ecology and health strategies and environmental protection offer limited solutions. Rapid globalization, *bushmeat* use, and wildlife trade have led to unprecedented interest in the ecology of infectious diseases and their effect on complex human population dynamic interactions including migration, famine, natural disasters, war, and terrorism. More than ever it is essential for ecologists to work with public health officials, veterinarians, economists, politicians, and the general public to understand the basic transdisciplinary science behind emerging infectious diseases, which in most cases are zoonotic with a wildlife origin.

'Thinking globally and acting locally' is a growing trend in the modern world, but the opposite 'thinking locally and acting globally' represents the need for global capacity in ecological training. We require research networks and communities of practice capable of breaking down institutional barriers and building collaborative bridges— so the next generation of ecological caregivers, conservation medics, and planetary doctors will be critical to turn around current trends. Consistent with this philosophy, we need to strive to ensure lasting local conservation impacts with global health solutions with every project by training community leaders, volunteers, school children, and university students.

3. ***Most infections have their origins in wildlife.*** *Wet markets* in China and other countries have represented major sources of emerging *zoonotic diseases* (= vertebrate animal to human transmission) including *SARS, MERS, Ebola* and most likely *COVID-19*. All those viral diseases point to a bat reservoir.

Overall, 61% of infectious diseases are zoonotic. From these about 75% have a wildlife origin. On the other hand, reversed zoonosis (or zooanthroponosis) that is, humans spillback disease to animals may also occur. For example, 600,000 mink were killed in Dutch fur farms in

attempting to eradicate COVID-19, that passed back and forth at least three times from humans to mink.

4. ***The 'exotic' pet trade.*** "Exotic" is a term that simply means an animal imported from a region outside of its natural or native habitat. Exotic reptiles, which often carry *Salmonella* bacteria, are a big business. Over 20 million reptiles were traded legally over four years and in 1997, the USA imported 1.8 million live reptiles worth more than $7 million, and exported 9.7 million valued at more than $13.2 million. A single ploughshare tortoise (*Astrochelys yniphora*) from Madagascar will bring $30,000 in the U.S. market. **That country's per capita income in 2020 was US$456.00. Is it any wonder that nearly half the remaining population of this species was stolen from a captive breeding program in Madagascar? There is no excuse for a legal exotic pet trade from the point of view of maintaining the integrity of public health.**

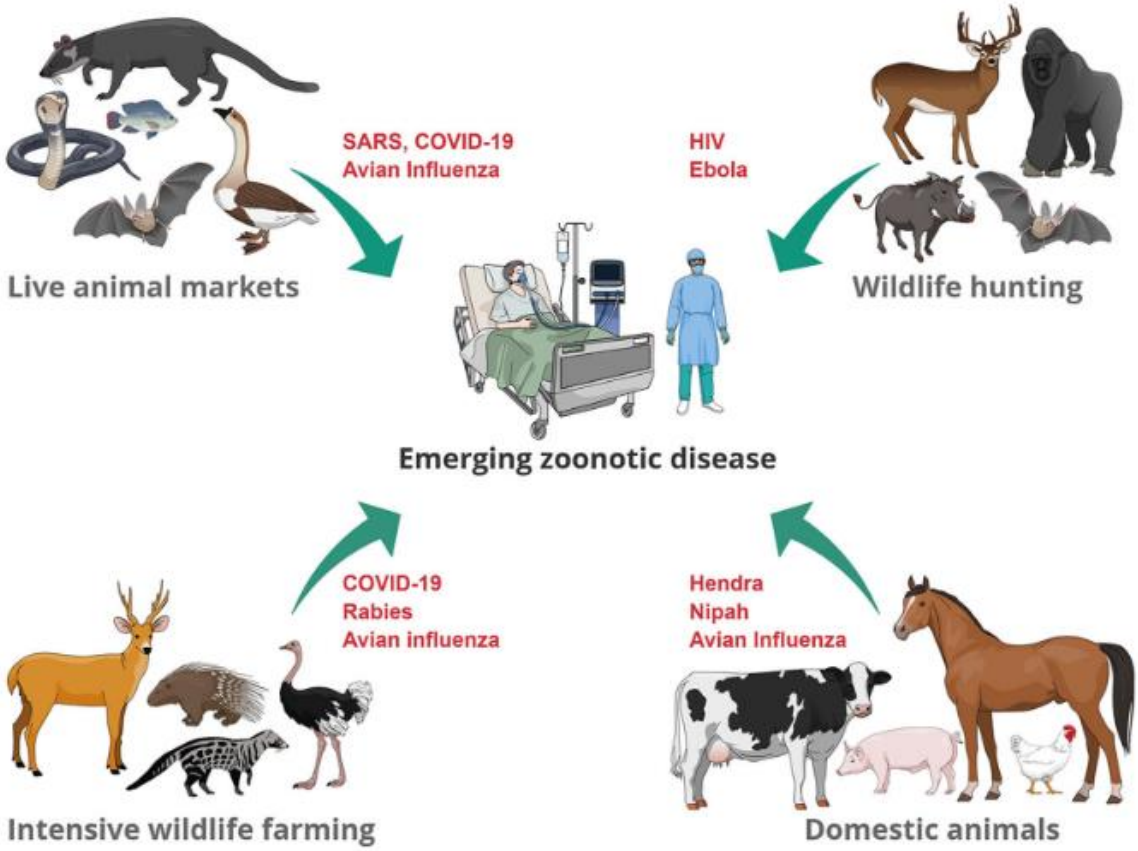



Fig. 2. Transmission pathways of zoonotic diseases that emerged and re-emerged including direct contact through handling of living animals (wildlife trade, domestic animals), preparation of slaughtered animals for consumption of meat or for traditional medicine use (Magouras et al. 2020).

5. ***Human health was at risk as a monkeypox virus outbreak revealed.*** The *monkeypox virus* does not transmit easily among a group of people; regular contact with more efficient animal carriers is needed. Therefore, if a monkeypox-infected person carries the disease across our borders from Africa, the case would most likely be an isolated event. The introduction of

imported wildlife into the story brings the added complication – not just the disease - that its animal host came into our country and found a potential local *reservoir* for the disease. A pet prairie dog shedding the virus could conceivably spread the disease to a nearby house mouse. Well-meaning but ignorant people have been known to clandestinely release pet prairie dogs into former prairie dog habitats. This could become an efficient means to establish monkeypox in squirrel and rodent populations in the United States.

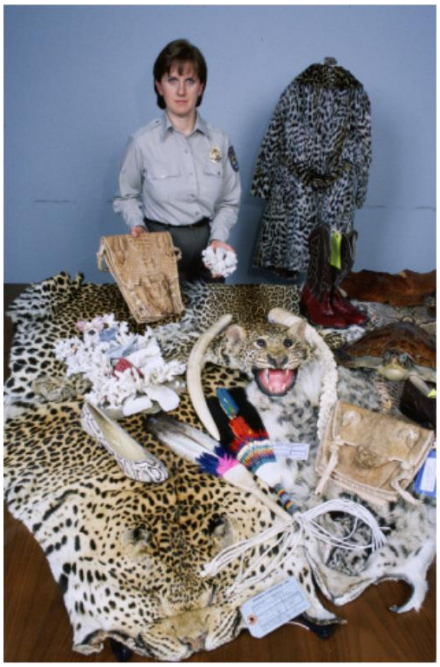
6. ***Human invasion of wildlife habitats increases exposure to exotic infections***. Diseases such as Ebola, MERS, SARS and most likely COVID-19, have emerged as humans live in increased proximity to wildlife, either through new settlement areas, expansion of farmland, or encounters in live animal markets and pet shops. The rapid movement of animals and people across national boundaries and ecosystems brings diseases to naïve new hosts. **People frequenting live exotic animal markets or pet shops run the same risk of acquiring a new parasite as if they themselves had explored a remote rain forest that was the origin of the animals for sale**.

7. ***The wildlife trade is exceptionally profitable.*** It will be difficult to stem the flow of wildlife and their pathogens carried in and out of the USA, despite our witnessing one infectious emerging disease after another entering this country. Why? Because *the wildlife trade is a $23 billion dollar industry, half of it illegal***,** only surpassed by the traffic of drugs and guns. The illegal wildlife trade is a transnational environmental crime that harms tens of thousands of vertebrate species. Importantly, weight for weight wildlife *is equally or more profitable* than arms and drugs. Poachers can earn US$1000 per gram for a rare animal part, 20 times the profit of heroin.

The USA is largest importer of legal and illegal wildlife in the global marketplace, with approximately US$773M annually in importing and $256M in exporting wildlife since 1989. These include *only declared shipments*. Another US$100-$250M in smuggled or fraudulently mismarked shipments cross the US borders each year. The poor and unsanitary conditions of capture, transportation and sale cause 90% mortality prior to reaching their final destination; that is, for each live animal reaching the USA market place at least 10 are taken from the wild! This trade includes millions of individual items put into international trade: 25,000-30,000 live primates, 2-5 million live birds, 5-6 million live reptiles, 10-15 million reptile skins, 500-600 million live fish, and 1,000-2,000 tons of raw coral. *And this does not include wildlife traded solely within the USA*. The illegal wildlife trade in Brazil alone surpasses the 2 billion dollar mark while over 12 million wild turtles are sold to China each year. A macaw can bring as much as $8,000. Over 100 palm macaws from Indonesia were confiscated from a shipment to the U.S. from Malaysia, with a retail value of nearly $1 million. **For all the profits involved, the risks of illegal trade are small.** The U.S. Fish and Wildlife Service has been able to detect and confiscate only an estimated 3% of the illegal shipments of wild animals into the U.S. Even when smugglers are caught, the **maximum jail sentence for illegal transport or sale of wildlife is only 5 years**.

8. ***Wildlife parts and products are not the exception***. Elk antlers are sold US$120 per pound and up to US$1,950 for large elk rack in Jackson, Wyoming. Heads of bighorn sheep are

sold for US$2,000-$2,500; trophy heads for US$8,000 to $10,000; and one sheep grand slam, consisting of harvesting all four wild sheep species in North America including Dall, Stone, Bighorn and Desert Sheep can go for more than US$45,000 legally. Bear gall bladderrs, consiered to have medicinal properties in Chinese medicine will go for US$15.00 each in Idaho; $150-$300 in other US states; $1,500 in Hawaii; and $15,000 in Korea. A record price has been $55,000 for one. A jaguar skin can bring $3,000. Bear parts are a big business, running from $4 for a claw, $400 for a pelt and $64,000 for a gall bladder.



Fish and Wildlife Service law enforcement officer showing illegal wildlife trade items confiscated at ports (Credit: Carl Zitzman, USFWS)

9. ***Diseases imported via wildlife come at a considerable cost.*** While some might argue that prestige seeking through ownership or consumption of exotic animals is a harmless vice, the truth is that the disease risk to humans and domestic animals is intolerable and the economic costs can be enormous. Potentially life-threatening diseases such as SARS, monkeypox virus, *West Nile virus*, and *campylobacteriosis* in all likelihood entered our country in the bodies of exotic animals or wildlife has served as a reservoir. The economic costs of not stemming the trade are considerable. For example, it is estimated that from 25,000 to 50,000 parrots are smuggled in to our country from Mexico each year. *Exotic Newcastle disease* (VVND) was discovered in pet birds and backyard poultry in Southern California in autumn 2002. By December the disease was confirmed in commercial flocks and over 1.2 million birds were euthanized. The last time VVND broke out in California was in 1971, when 12 million birds had to be destroyed at a cost of $56 million (the equivalent of $239 million in today's dollars). It took a year and a half to eliminate the disease, which was declared eradicated in 1974. The current outbreak is the first to infect commercial poultry in the United States since then.

SARS cost an estimated $40 billion dollars to the world economy in applying public health control measures.

10. ***Vulnerabilities to future infection outbreaks.*** Today, our livestock industries are vulnerable to new diseases introduced by exotic animals and their parasites. For example: an African tick called *Amblyoma* can transmit heartwater, an infectious disease that kills cattle, sheep and wild antelope in Africa. The disease, that causes accumulation of massive amounts of bloody fluid in the thorax, was discovered and eliminated in African tortoises introduced in Florida. *Amblyoma* has already spread to the Caribbean, and we run a constant risk that the small tick will hitch a ride to America. If the tick arrives, it will find a generous set of host animals, previously imported, that can transmit heartwater, into species native to North America. Moreover, in laboratory experiments, two of our native ticks have been able to carry the disease as well. This is a known vulnerability; there are many more unknown vulnerabilities.

11. ***Wildlife trade legislation.*** The wildlife trade is one of the primary causes of wildlife extinction with global consequences to the health of species and ecosystems. The reasons for the wildlife trade are mutiple and include the pet trade; food (bushmeat, wet markets); prayer or religious practices; traditional medicine; products (apparel, furniture, art, souvenirs); research; education; and tourism (cub petting, picture taking, zoos and other facilities). The USA has probaly the longest record on conservation laws in the world. By the 1890s most states had enacted some hunting and fishing laws. The Lacey Act, which disallowed commercial hunting and importing of illegally captured animals, was first introduced by Iowa Congressman John Lacey in the House of Representatives, during spring 1900, and then signed into law by President William McKinley on May 25, 1900. The law was ammended in 1969 to include amphibians, reptiles, mollusks, and crustaceans, Also in 1981, 1989, and 2008 to include plants and plant products, i.e. woods. However, the penalties are minuscule compared to other illegal traffic activities. It specifies a maximum penalty of five years incarceration; US$250,000 for individual and $500,000 for organizational violators; and vessels, vehicles, aircrafts, and other equipment used to aid in the unlawful import, export, transport, sale, receipt, acquisition, or purchase of fish, wildlife, or plants may also be forfeited.

12. ***So what can we do personally?*** First, do not purchase exotic pets such as parrots, monkeys, wild *felids*, turtles and tortoises, snakes, iguanas. These species are very difficult to maintain in captivity over time and can be dangerous. If they are released into the wild purposely (e.g. because they become inconvenient) or accidentally they can be devastating to native species, such a pythons, lion fish, and tegu lizards in Florida. You have many other options for pets, including freshwater fish, domestic cats and dogs, hamsters and many birds that have been domesticated.

Second, the time has come to recognize that the potential health costs of the wildlife trade, legal or illegal, are not worth the profits made in fostering a frivolous hobby or an unusual meal. We need to change our attitudes about wildlife, our relationship to nature and achieving a balance.

## Relevance for Sustainable Development Goals and Grand Challenges

- **Goal 1. End poverty.** Catching wildlife for the the international trade in exotic pets provides much-needed income to poor families (a *pull* parameter). Ending poverty will remove the financial incentive for this practice, thereby reduce supplies (*push* parameter) and contribute to reducing/controlling the trade
- **Goal 2. End hunger.** Apart from providing income to poor families, catching wildlife also puts much-needed food on the table: bushmeat. The provision of adequate food supplies for everyone will remove the need (though not necessarily the cultural appetite) for bushmeat.
- **Goal 3. Ensure healthy lives.** While companion pets contribute to mental health, exotic pets mediate the transmission of exotic infectious agents, promote zoonotic infections, compromise global public health measures significantly increase the probability of serious epidemics and pandemics.
- **Goal 8. Jobs for all.** Wildlife trade is a huge business and employs many people around the world. If we are to stem it, we need to create alternative employment opportunities.
- **Goals 14 and 15. Conserve land and sea.** A healthy world is a diverse world and species extinctions are rapidly reducing diversity. The exotic pet trade is seriously contributing to species extinctions (not only the primary extinction itself, but also unique and organism-specific members of its microbiota, and the effects on the ecological network and food chain/web in which the species is integrated).

## Potential Implications for Decisions

1. ***Individual***
    - **a.** Indigenous versus exotic companion pet (possible import of exotic diseases)?
    - **b.** High cost of an exotic pet.
    - **c.** Do I really want to contribute to the deprivation of freedom of a wild animal?
    - **d.** Do I realy want to contribute to species extinctions?

2. ***Community policies***
    - **a.** Education about the health issues of exotic pets
    - **b.** Education about the link between wildlife trade, species extinctions and loss of biodiversity

3. ***National policies***
    - **a.** Recognition of the role of the wildlife trade in existing and future infectious diseases and development of effective public health policies and enactment of appropriate legislation.
    - **b.** Engagement with countries where wildlife trade occurs and coordination of activities to stem it.

**c.** Participation in international organisations and efforts to restrict wildlife trade
**d.** Participation in international organisations and efforts to provide alternatives to employment and food provision involving wildlife trade

**Pupil Participation**

1. ***Class discussion of the issues associated with exotic pet ownership***

2. ***Pupil stakeholder awareness***
    a. Exotic pet ownership has negative consequences for the SDGs. Which of these are most important to you personally/as a class?
    b. Can you think of things that might be done to reduce these consequences?
    c. Do you think it is acceptable to capture a wild animal and place it in captivity?
    d. What environmental services can you imagine that different exotic pets provide in their natural habitats (hints: pollination, seed dispersal, food chain, etc)?
    e. What is the connection between species diversity, ecological health of habitats and extinctions? How does the wildlife trade affect these components?

**The Evidence Base, Further Reading and Teaching Aids**

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## Glossary

*Bushmeat*: meat of wild animals, but it most often refers to the remains of animals killed in the forests and savannas of Africa.
*Campylobacteriosis*: infection by the group of bacteria known as *Campylobacter*. The term comes from the Greek word meaning "curved rod" referring to the bacteria's curved shape. In many instances, wild carcasses or meat are contaminated by *Campylobacter* from faeces during slaughtering. The most common disease caused by these organisms is diarrhea, which most often affects children and younger adults.
*COVID-19*: Stands for Coronavirus Disease 2019, responsible for the current pandemic that was first identified in Wuhan, China in December 2019. As of February 2022, it has infected almost 405 million and killed almost six million humans globally. It is characterized by a mild to severe respiratory illness that is caused by a coronavirus (*Severe acute respiratory syndrome coronavirus 2* of the genus *Betacoronavirus*), that is primarily transmitted by contact with infectious materials such as respiratory droplets. It is characterized by fever, cough, and shortness of breath and may progress to pneumonia, respiratory failure, and death.
*Ebola*: Ebola is a deadly, viral disease with occasional outbreaks that occur mostly on the African continent. It most commonly affects people and nonhuman primates (such as monkeys, gorillas, and chimpanzees). It is caused by an infection with a group of viruses within the genus *Ebolavirus*. It was first discovered in 1976 near the Ebola River in what is now the Democratic Republic of Congo.
*Newcastle disease*: Called exotic Newcastle disease (END) in the USA, is an important infectious disease of poultry and other bird species and is a worldwide threat to poultry production. The cause is a virulent strain classified by the international standard molecular and chicken inoculation tests. The USA is considered free of END in poultry because all recent outbreaks have been eradicated. The virus has been introduced by the illegal importation of psittacine birds (parackeets, parrots, macaws) through the illegal wildlife trade.
*Felids*: Are a family of mammals in the order Carnivora, colloquially referred to as **cats**.
*MERS*: Middle Middle East Respiratory Syndrome (MERS) is an illness caused by a virus (more specifically, a coronavirus) called Middle East Respiratory Syndrome Coronavirus (MERS-CoV). Most MERS patients developed severe respiratory illness with symptoms of fever, cough and shortness of breath. About 3 or 4 out of every 10 patients reported with MERS have died. Health officials first reported the disease in Saudi Arabia in September 2012. Although most of human cases of MERS-CoV infections have been attributed to human-to-human infections in health care settings, current scientific evidence suggests that dromedary camels are a major **reservoir host** for the virus and a source of human infection.
*Monkeypox Virus*: Monkeypox virus belongs to the *Orthopoxvirus* genus in the family *Poxviridae*. The *Orthopoxvirus* genus also includes variola virus (which causes smallpox), vaccinia virus (used in the smallpox vaccine), and cowpox virus. Monkeypox was first discovered in 1958 when two outbreaks of a pox-like disease occurred in colonies of monkeys kept for research, hence the name 'monkeypox.' The first human case of monkeypox was recorded in 1970 in the

Democratic Republic of the Congo during a period of intensified effort to eliminate smallpox. African rodents and non-human primates may harbor the virus and infect people. It was introduced in the USA through the illegal importation of Gambian rats.

*Reservoir*: The reservoir of an infectious agent is the habitat in which the agent normally lives, grows, and multiplies. Reservoirs include humans, animals, and the environment. The reservoir may or may not be the source from which an agent is transferred to a host.

*Vector*: A vector is a living organism that can transmit infection to a succession of hosts. Most disease vectors are insects, and mosquitoes are responsible for causing the most human illnesses in the world. Fleas and ticks are also common disease vectors.

*West Nile virus*: WNV is the leading cause of mosquito-borne disease in the continental United States. It is most commonly spread to people by the bite of an infected mosquito. Cases of WNV occur during mosquito season, which starts in the summer and continues through fall. There are no vaccines to prevent or medications to treat WNV in people. Fortunately, most people infected with WNV do not feel sick.

*Wet Market*: A market where fresh meat, fish, fruit, vegetables and sometimes live animals are sold to the public.

*SARS*: Severe Acute Respiratory Syndrome is an infectious disease caused by a coronavirus, with initial clinical signs including fever and cough and in some cases progressing to pneumonia and respiratory failure. It was first recognized as an epidemic that began in Gaungdong, China in 2002, linked to civets sold for consumption in wet markets. Bats have been identified as potential natural reservoirs of the disease.