The Next Plague Part 2: 1940 - New Infections Arrive, But From Where?

By Steve Schow — March 13, 2017

Estimations of emerging infectious diseases between 1940 and 2004, suggest 335 such entities appeared in that period, or about five emerging infectious disease events per year. NOTE: There are three categories of infectious diseases: 1) established infectious diseases like TB, malaria, and tapeworms; 2) newly emerging infectious diseases like SARS, MERS, new influenza subtypes, Nipah, Lyme disease, and HIV; and 3) re-emerging diseases like West Nile virus in the Americas, MRSA, XDR-TB and vancomycin-resistant enterococci.

New human pathogens must come from somewhere. Unsurprisingly, most arise from animals. Around 72% of current human infectious diseases, even those exclusively in humans like measles, pertussis, mumps and hepatitis B, are of zoonotic origin, probably coming from wild animals. Microbes that normally colonize animals spill over into humans once they acquire the attributes that allow them to do so. Darwinian evolution drives the adaption and survival optimization of the microbe for human hosts. The infectious organisms may become so finely tuned to humans that they become exclusive pathogens of humans. Classic cases of opportunistic spillover from animals to humans include HIV (primates), monkeypox and Ebola (primates); SARS and MERS (civet cats and bats); human Q-fever (dairy goats) and influenza (waterfowl and swine).

Foodborne and waterborne pathogens are another frequent source of infections. These include spongiform encephalopathies, norovirus, cholera, salmonella, campylobacter, staphylococcus aureus, Nipah, toxoplasma, listeria, giardia, hepatitis A and cryptosporidium.

Biological warfare is the application of infectious disease weapons in war. Humans, who have a special gift for exploiting their environment to their evolutionary advantage, quickly realized
biological agents could be used against their enemies. This appears to have begun with Hannibal catapulting clay pots of venomous snakes, like cobras and vipers, onto the decks of King Eumenes’ siege ships. Hannibal won the battle. During the Middle Ages, excrement from and bodies of Black Plague victims were catapulted into fortresses under siege. In both North and South America, items contaminated with smallpox, were presented to the Native peoples, leading to a massive die-off of Natives who had never been exposed to smallpox even in their pre-Americas history. Modern era biological warfare began in the Civil War when Confederate troops fleeing Sherman’s advancing forces systematically poisoned drinking water sources with the carcasses of dead livestock, something Sherman complained about in his *Memoirs*. By the beginning of the 20th Century, biological warfare technology had come of age.

There are basically six types of infectious organisms (excluding arthropods like mites and lice) that plague the human body:

- Prions
- Viruses, which include RNA, DNA and retroviral RNA viruses
- Bacteria, rickettsia and mycobacteria
- Fungi
- Parasites of various types, including protozoa
- Helminths, including nematodes, flukes and tapeworms

Species from each of these classes of infectious agents can cause devastating effects on humans and several are among the leading causes of morbidity and death in the world. Some are ubiquitous in the environment and others are quite rare. The human immune system dispatches some better than others. Only when a person’s immune system is compromised can normally benign or in-check infectious agents become an issue. Some infections are totally untreatable, others are successfully controlled in some human subpopulations, while others are not controllable at all. Some are acquired by vector delivery (mosquitoes and ticks) and in association with animals such as dog and cats, whereas others are just encountered in the environment, including waterborne and foodborne agents. The control of many of these diseases has been brought about by the introduction of modern sanitation methods such as modern food processing, sewage disposal, water purification and vector control, as well as with vaccines and anti-infective medicines. However, many infectious diseases are not well-controlled, and in fact, constitute the great ongoing plagues in the world.

Next, I will discuss each class of infectious agents starting with the simplest transmissible infectious agent, prion proteins.