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Comets and Contagion: Evolution and Diseases From Space

R. Joseph, Ph.D.[1], and Chandra Wickramasinghe, Ph.D.[2],
[1]Emeritus, Brain Research Laboratory, Northern California.
[2]Astrobiology Centre, Cardiff University, UK

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Abstract

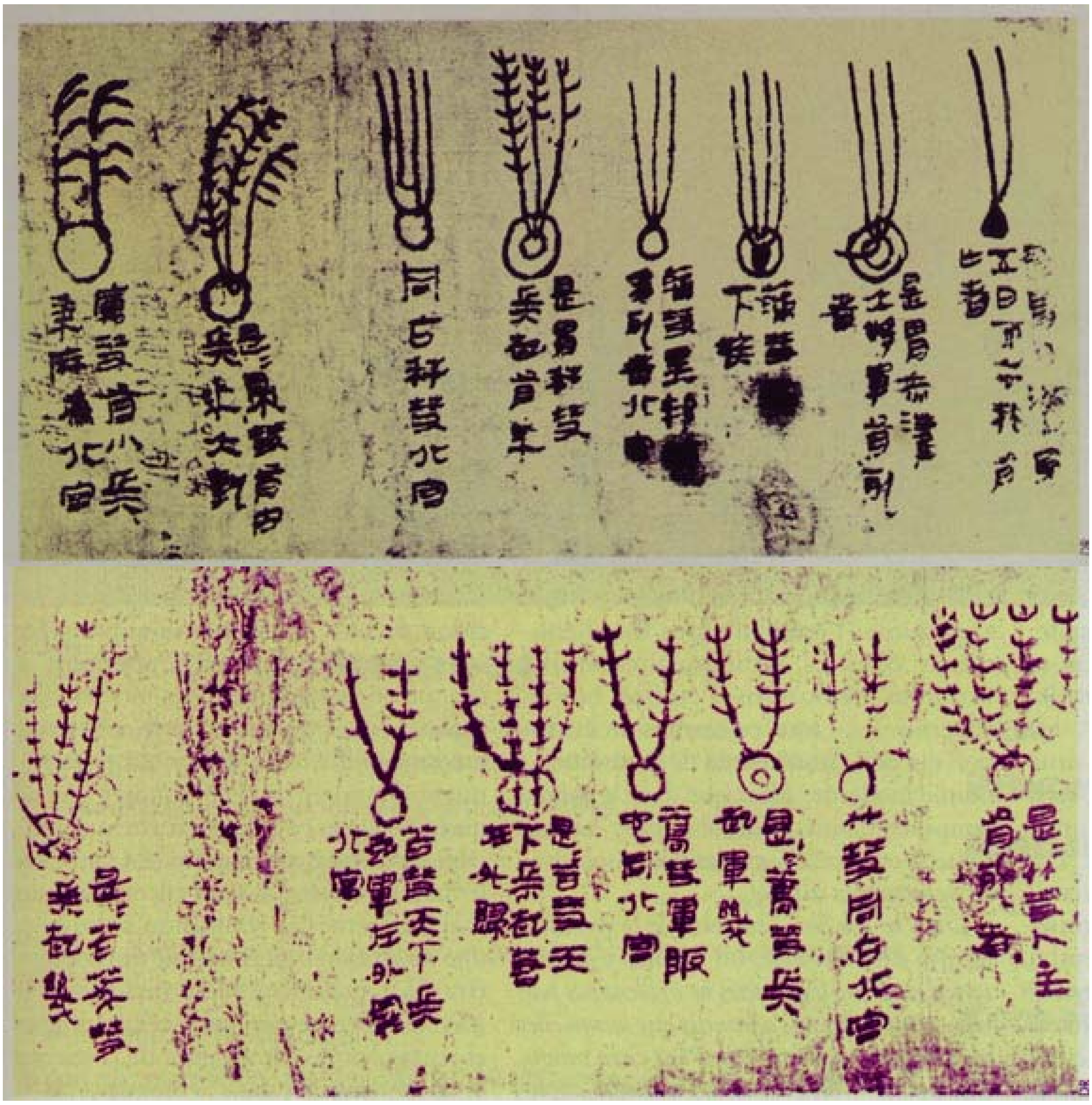
For much of history comets have been associated with death and disease. There is increasing evidence that life on Earth originated in comets and other stellar debris. If passing comets have continued to deposit viruses and microorganisms on this planet, this may explain why ancient astronomers and civilizations attributed the periodic outbreak of plague to these stellar objects. Moreover, the subsequent evolution and extinction of life may have been directly impacted by the continued arrival of bacteria, archae, viruses, and their genes from space. On this picture the evolution of higher plants and animals, including humans, would be impacted by the insertion of genes from space, as well as recurrent episodes of pandemic disease. Near-culling pandemics and extinction episodes have in fact been preceded by or followed by inserts of viral genes into survivors who have transmitted these viral elements to their progeny, thereby impacting future evolution. Although ancient fears and reverence of comets may be coincidental with the outbreaks of pandemics, they may also have a factual basis.

Keywords: Panspermia, life, interplanetary transfer, disease, death, plague, pandemic, 1918 flu, comets

1. "Comets Are Vile Stars"

All ancient civilizations, without exception, have looked upon comets with a sense of trepidation and awe. Comets were considered to be harbingers of doom, disease, and death, infecting men with a blood lust to war, contaminating crops, and dispersing disease and plague (Hippocrates 1900; Olson and Pasachoff 1999). Although some of the alleged correlations could be dismissed as mere coincidence, a belief that emerged after centuries and millennia of observation merits some measure of deference and openness to additional scientific inquiry. The views of ancient civilizations – the Chinese, Egyptians and Indians, that laid the foundations of philosophy and science, including astronomy (Belmonte, 2010; Lockyer 1997; Pankenier 2010) - should not be so easily be dismissed.

Ancient Chinese astronomers chronicled numerous episodes where the apparition of comets preceded plague and disaster. Meticulous observations were compiled in 300 BC in a series of *books* known as the "Mawangdui Silk" (Ling-feng 1976) It details 29 different cometary forms and the various disasters associated with them, dating as far back as 1500 B.C: "Comets are vile stars. Every time they appear in the south, they wipe out the old and establish the new. Fish grow sick, crops fail, Emperors and common people die, and men go to war. The people hate life and don't even want to speak of it." - Li Ch'un Feng, Director, Chinese Imperial Astronomical Bureau, (648, A.D).



Figures 1 & 2.The Mawangdui silk, depicted 29 different cometary forms and the various diseases and disasters associated with them. Compiled, beginning around 1500 BC.

If there is any truth to these claims, then we should also ask if comets, or other stellar objects, have caused not just death and disease, but the eradication of entire species leading to extinction. For example, it is well established that the demise of the dinosaurs is directly associated with a collision between Earth and an asteroid about 10 km in diameter, 65 million years ago (Alvarez 2008; Alvarez, et al 1979). However, the die off was not instantaneous but followed a pattern suggestive of spreading contagion (Poinar and Poinar 2007). In fact, Poinar and Poinar (2007), basing their findings on pathogens found within amber-entombed insects, have concluded that the extinction of the dinosaurs was due to "the cumulative, cascading effects of many diseases." Could bacteria and viruses have been buried within the Chicxulub asteroid and then released upon impact or entry into the atmosphere? And if so, might they have played a role not just in the extinction of dinosaurs but the evolution of new species? Although we can answer neither "yay" or "nay" to these questions, there is considerable evidence that bacteria and viruses from space have directly impacted the evolution of new species, including humans (Joseph 2009a,b). Likewise, there is evidence to suggest that humans have suffered massive die offs following exposure to bacteria and viruses from space (Hoyle and Wickramasinghe 1979).

2. Plague: The Historical Record

Figure 3. Comet of 1857.

From Biblical times great plagues and epidemics of disease have punctuated the history of Europe and Asia (Karlen 1996; McNeill 1977). Although some of these events may have an explanation in terms of local causes and conditions, the more dramatic episodes on record invite more exotic explanations that may be linked to comets.

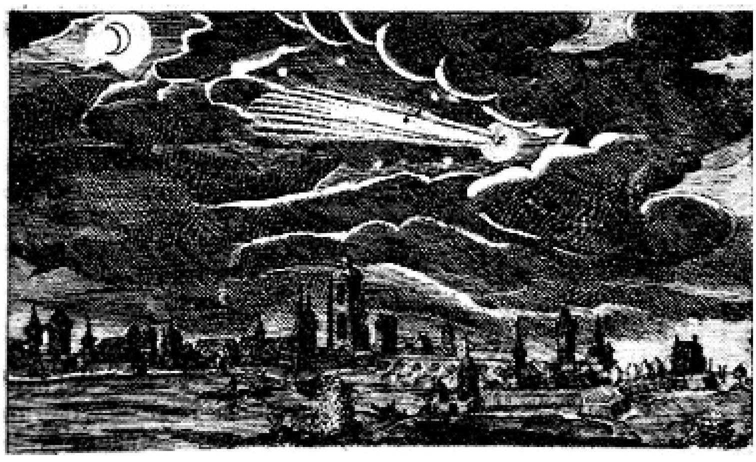


Figure 4. Comet of 1618 was associated with the coming "end of the world" and spreading death and disease.

The great plague of Athens that broke out in the year 430BC (Karlen 1996) is a strong candidate for a cometary cause. The epidemic was localized geographically, and declined and disappeared as abruptly as it had started and no source could be discovered. The description of the epidemic and its symptoms described by the historian Thucydides (2004), has defied identification with any known infectious disease.

In the first century AD, the Greek physician Rufus of Ephesus, refers to an outbreak of a devastating pandemic in Libya, Egypt, and Syria (Karlen 1996; McNeill 1977). The popularly accepted cause of the pandemic is bubonic plague caused by the bacillus *Yersinia pestis*, in which flea-infected rodents act as an intermediate vector. But what was the source of the bacillus? At around the same time Marcus Manilius (10-20 AD) wrote thus:

> "Death comes with those celestial torches, which threaten earth with the blaze of pyres unceasing, since heaven and nature's self are stricken and seem doomed to share men's tomb."
>
> "In times of great upheaval rare ages have seen the sudden glow of flame through the clear air and comets blaze into life and perish."

Half a millennium later The Plague of Justinian (541-542AD) scourged and afflicted the Byzantine Empire, including its capital Constantinople, causing mass death. The popularly accepted cause of the pandemic is also bubonic plague (McNeill 1977).

These plagues are all bacterial diseases which are spread by infected fleas, by contact with the body fluids of infected people and animals, and by inhaling infectious droplets in the air. How did fleas come to be infected? Were they also contaminated by pathogens in the air?

3. Bacteria and Viruses From Space?

Yersinia pestis is one of the causative agents of plague. *Yersinia pestis* are anaerobic and must live within host cells during the infective phase of its life cycle (Brown et al., 2006; Perry and Fetherston 1997; Wickham et al., 2007). Infection takes place through a syringe-like apparatus by which the bacteria can inject bacterial virulence factors (effectors) into the eukaryotic cytosol of host cells. Yet, as they are anaerobic, *Yersinia pestis* (and other pathogenic bacteria) are completely dependent on their host species, and cannot be propagated over evolutionary time if the host dies (Brown et al., 2006). Thus it must be asked: what is the origin of these plague-inducing bacillus which periodically infect and kill huge populations over diverse areas, and then reemerge hundreds of years later to attack again? In fact, *Yersinia pestis* is the causative agent responsible for at least three major human pandemics: the Justinian plague (6th to 8th centuries), the Black Death (14th to 19th centuries) and modern plague (21st century).

Figure 5. Yersinia pestis

The keys to unlocking this mystery may include the fact that these microbes are anaerobic (Brown et al., 2006), resistant to freezing (Torosian et al., 2009), and they periodically obtain many of their infective genes from other bacteria and viruses such that their genome is in flux and undergoes periodically rearrangement following the addition of these genes (Parkhill et al., 2001). A major anaerobic, freezing environment is located in space. Therefore, could these microbes have originated in space?

A variety of microbes have been discovered in the upper atmosphere, including those who are radiation resistant (Yang et al., 2010), and at heights ranging from 41 km (Wainwright et al., 2010) to 77 km (Imshenetsky, 1978) and thus in both the stratosphere and the mesophere which is extremely dry, cold (−85 °C (−121.0 °F;), and lacking oxygen. It is the mesophere where meteors first begin to fragment as they speed to Earth (Wickramasinghe et al., 2010). Could these upper atmospheric microbes have originated in meteors or from other stellar debris? Or might they have have been lofted from Earth to the upper atmosphere?

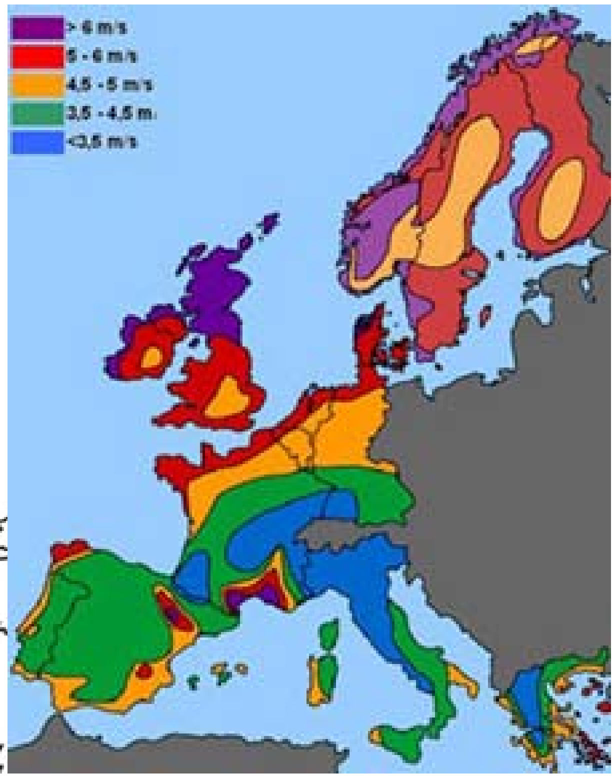
The natural mechanisms which transport microorganisms to the upper atmosphere are storm activity, volcanic activity, monsoons, and bolide impact events (Joseph 2009c; Joseph and Schild 2010a; Wainwright et al., 2010; Yang et al., 2010). Wainwright et al., (2010) presents data indicating that microbes are also being deposited in the upper atmosphere from space; a view consistent with Hoyle and Wickramasinghe (1979, 2000; Wickramasinghe et al., 2010). Wainwright et al., (2010) also proposes that through horizontal gene transfer, microbes from space insert genes into terrestrial microbes. According to Joseph and Schild (2010a; Joseph 2009a,b) viruses accompany these microbes and store and provide genes which are of benefit to the bacterial host. However, they also argue that these inserted genes may introduce genetic *errors*into the host, triggering death and disease.

However, there are other factors to consider: UV rays and fluctuations in solar activity. Wainwright et al., (2010) argue that the genomes of microbes in the upper atmosphere may suffer UV-ray induced mutations. Further, cyclic fluctuations in solar activity could also directly impact the genomes of microbes within the upper atmosphere. Thus, if they originate in space or from Earth, those microbes or viruses who suffer UV damage or genetic mutations do to cyclic increases in solar activity, may also insert these damaged genes into other bacteria which then infect the animals and plants of Earth.

Consider, for example, the 1918 flu pandemic which was caused by the combination of *new* viral genes with old viral genes, such that a new viral strain transferred its genes to an old viral strain, creating a deadly hybrid which killed maybe as many as 100 million humans. However, the first to be infected were birds, thus suggesting the source of the disease came from the sky.

Therefore, we are presented with a variety of scenarios which might be linked, and all involve the transfer of genes, including those which may have been mutated by UV rays or increased solar activity, and those which originated in bacteria and viruses from space. If these scenarios (or variations thereof) are accurate, this could explain the origin of *Yersinia pestis* and their variable gene pool which periodically acquires infective or mutated genes thus inducing plague after they fall to Earth.

The Black Death (1334-1350AD) for example, has all the hallmarks of a space incident component or trigger. That this disease spread from city to city has been well documented (Kelly 2006; McNeill 1977). However, the progression of the disease did not follow contours associated with travel routes, displaying a patchiness of incidence including zones of total avoidance (Figure 6). Moreover, the pattern of infection appear to travel the course of prevailing winds (Figures 7 and 8). This does not accord with straightforward infection via a rodent/flea carrier as is conventional to assume. Hoyle and Wickramasinghe (1979) interpreted these patterns as indicative of a space incident bacterium.



Figures 6 & 7. (Left) Contours of the spread of the Black Death, from Carpentier. (Right) Wind Patterns

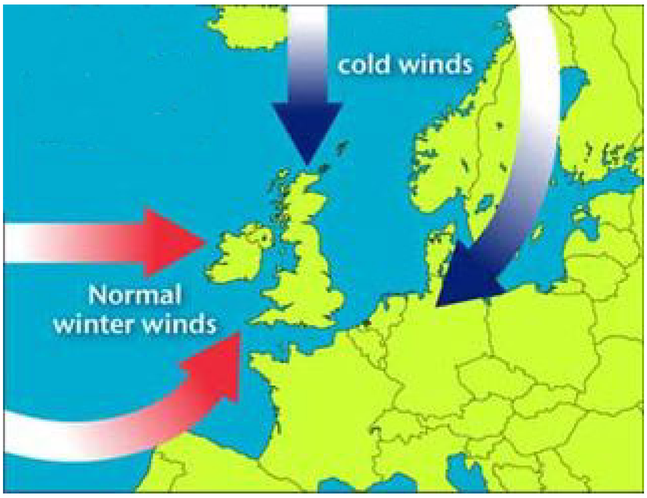
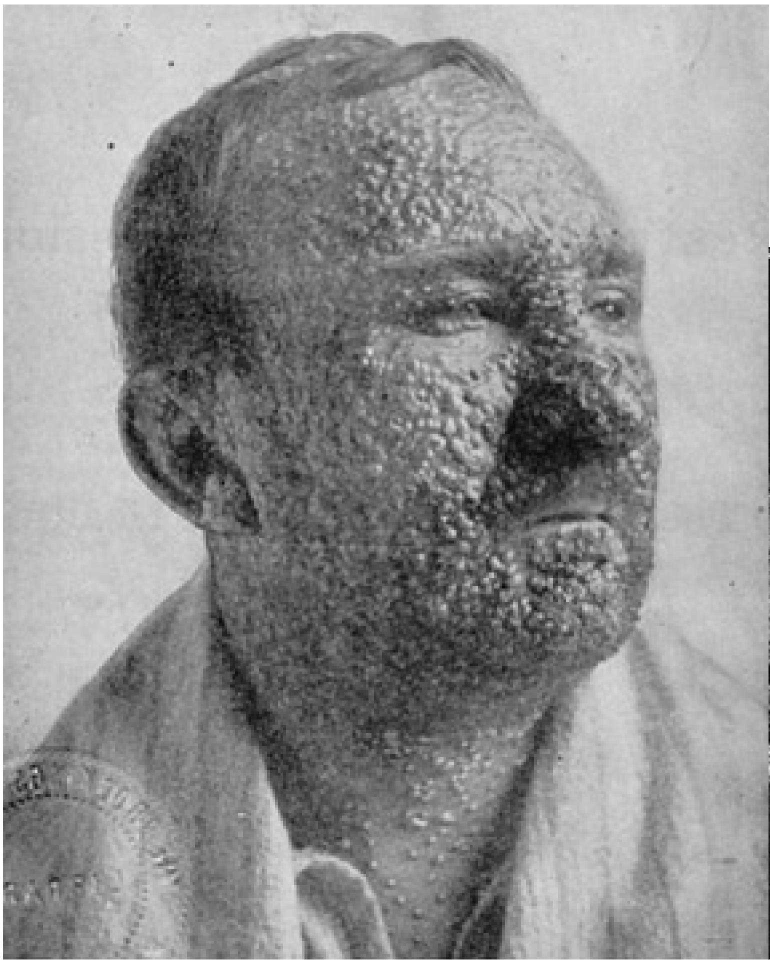


Figure 8. Winter wind pattern.

During the 20th century, smallpox may have killed 500 million people (Koplow, 2003). However, small pox is not due to a bacteria, but is caused by virus. Nevertheless, like bacteria-triggered plagues, this virus is host-dependent (i.e. "man"), and infects widespread populations only intermittently and periodically, with recurrent entrances and exits separated by several centuries. For example, there is evidence of small pox epidemics dated to 12,000 years before the present (Barquet and Domingo 1997). Records from India dated to 1500 B.C. and from China dated to 1122 B.C., also describe smallpox epidemics (Hopkins 2002). The Plague of Antonine (AD 165-180) detailed by Galen was possibly the best documented pandemic of smallpox in the ancient historical record (Hopkins 2002; Karlen 1996; McNeill 1977). In 1507, small pox invaded the "New World" beginning in the Caribbean and jumping to the mainland in 1520 (Fenner 1988; Li et al., 2007). However, a "molecular clock" genetic analysis of the small pox virus, Variola major, indicates that at least two strains of this host-specific entity can be dated 16,000 years before the present (YBP) in East Asia, and to 68,000 YBP in Africa (Li et al., 2007). Moreover, genetic variants of this virus appears in 6,300 YBP, 1,400 YBP, and 800 YBP (Li et al., 2007).



Figures 9 & 10. Victims of small pox.

The small pox virus, like the plague, has an intermittent record of periodic and quite deadly attacks, which are punctuated by centuries long periods of stasis. It is also transmitted via the air, or through direct contact with an infected person. Might the small pox virus also originate in space?

Viruses have been shown to survive simulated extraterrestrial conditions (Fekete et al., 2004; Walker, 1970), and the most extreme of environments (reviewed by Joseph 2009a,b). Moreover, many types of viruses are radiation resistant (Fekete et al., 2005; Hijnen et al., 2006; Jung et al., 2009), and freezing temperatures will increase the radiation resistance of various species of virus (Jung et al., 2009). Those which are dehydrated and which are double stranded are the most radiation resistant, and this includes the small pox (double stranded) variola virus (Sullivan et al., 1971).

Given the ancient history of the small pox virus and its radiation, dehydration, and cold temperature resistant genome, coupled with the periodicity of its infection cycles, there is thus good reason to suspect this virus originated in space.

4. Comets and Contagion

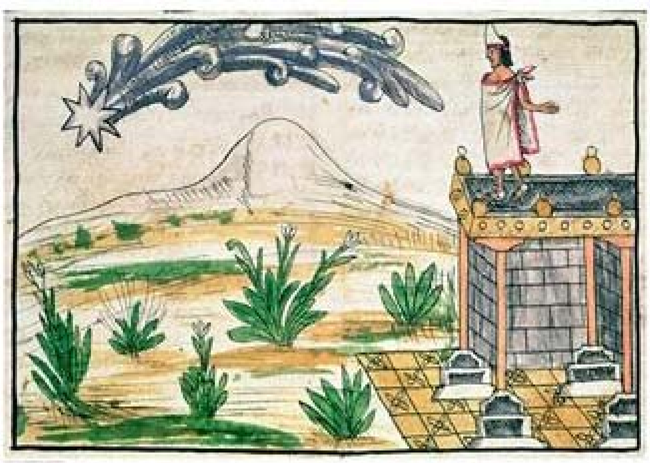


Figure 11. Montezuma watching a comet appear in the East

In the year 1519, a comet appeared in the skies over ancient Mexico, witnessed by Montezuma, the Aztec Emperor. That same year plague began to sicken and kill the native peoples, tens of millions subsequently dying of the disease (Fenner 1988; Li et al., 2007). Two continents were nearly culled of its native people.

The comet, however, may likely have had nothing to do with this deadly contagion, for that same year, Cortes and his soldiers arrived off the Coast of Mexico, possibly bringing with them plague and disease. The Aztec priests, however, believed that Cortez, the comet, and the contagion, were heaven-sent.

From November of 1680 to February of 1681, a comet blazed across the morning skies of New England, prompting the Reverend Increase Mather to deliver an incendiary sermon he called: "Heaven's Alarm to the World" (Gleiser 2003). The comet, Mather preached, was a sign of God's anger and warned of disease, pestilence and disaster.

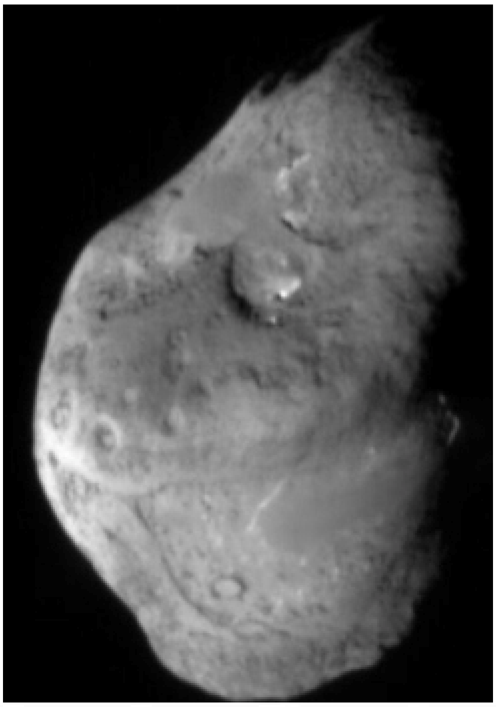
When a second comet appeared in 1682, Mather delivered another sermon of doom (Gleiser 2003):

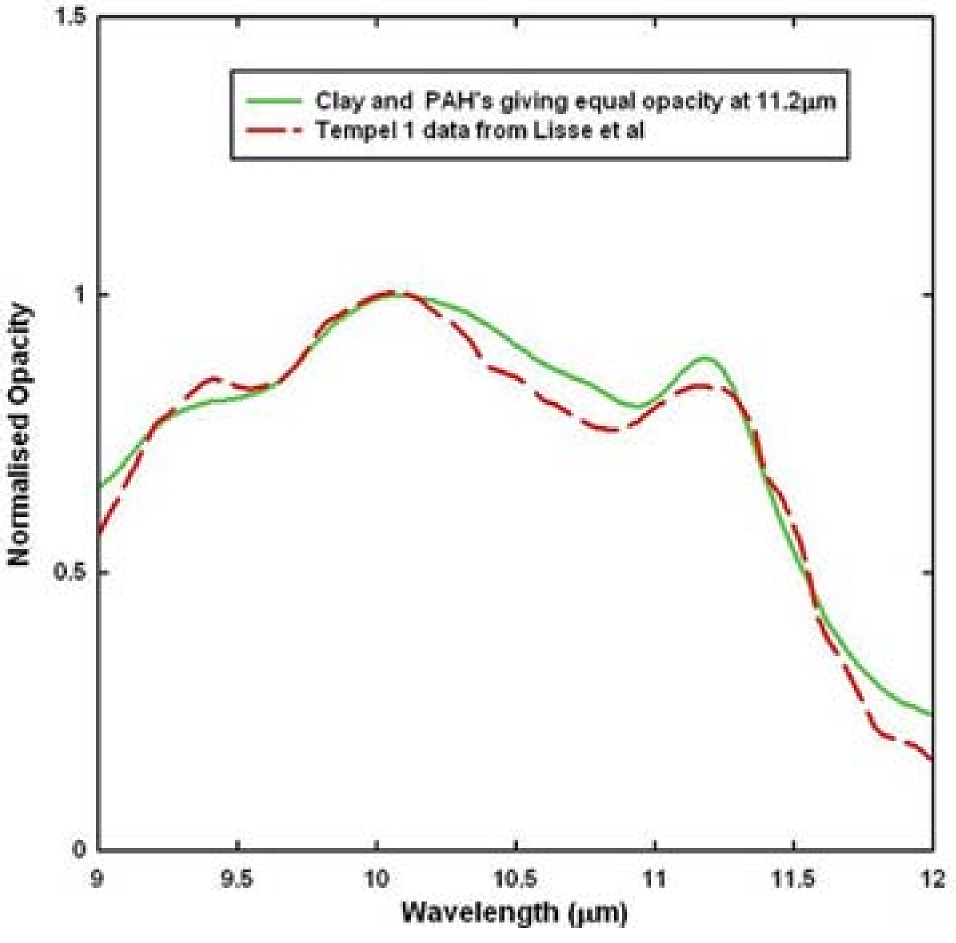
> "The Voice of God in Signal Providences: God in his providence doth order, as that sometimes, Blazing Stars are seen in heaven. Such stars are called comets for they stream like long hair... and strike a terror into the hearts of men that are spectators of them. Fearful sights are called signs in the scripture... they are signs that the Lord is coming forth out of his holy habitation to punish the world for their iniquityes. Tokens of God's Anger, they are Presages of great and publick Calamities."

Figure 12. Comet of 1681.

5. Comets and Shooting Stars

Comets come in all sizes, the larger ranging from 20 kilometers (12 miles) to over 300 kilometers (186 miles) in diameter (Wickramasinghe et al., 2010). Data recently obtained from Comet Tempel 1 in NASA's Deep Impact Mission showed evidence of recently frozen lakes at the surface as well as clay, organics and water in the material ejected from below the surface (Figure 13). The presence of clay particles proved that liquid water once existed in quantity within the comet, thus confirming theoretical predictions that the interiors of comets were initially melted by radioactive heat sources. There is no reason whatsoever to think that the organics found in comets were not produced by biological organisms (Wickramasinghe, 2010). Microbes may flourish or lie dormant in the heart of comets.





Figures 13 & 14. (Left) High resolution image of Comet Tempel 1 showing dark surface with relic frozen lakes. (Right) Infrared evidence of clay and polyaromatic hydrocarbons.

When a comet approaches the sun, solar radiation and blasts of energetic particles from the solar wind begins to heat, melt, and vaporize the surface layers of ice. The comet then sheds particles comprised of silicates (rocks) and organic material and ionised gas. These form two separate tails – a plasma tail and a dust tail, each of which are millions of miles in length. In addition to these two tails, comets sometimes fragment and eject much larger pieces that co-orbit with them around the sun. Examples are seen in break-up of Comet Linear in 2001 and of Comet Schwachmann-Wachmann in 2006 (Figures 16 and 17), and these fragments include what are described as meteors and asteroids.

Figure 15. The Swan Comet

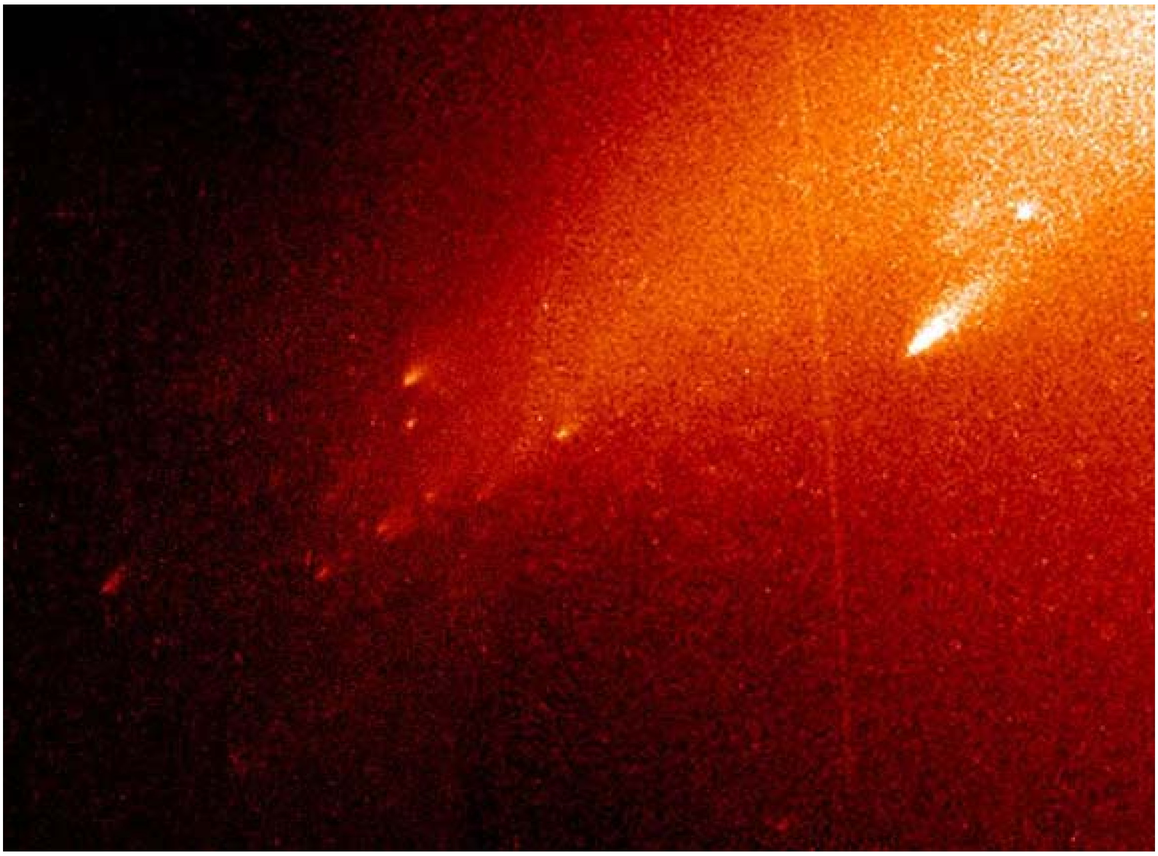


Figure 16. Hubble telescope image of fragments of Comet Linear (2001)

Figure 17. Hubble telescope image of fragment of Comet Schwassman Wachmann (2006)

Not uncommonly, the comet's tail may cross the orbit of Earth. Tiny particles of solid material (cm – mm in size) ignite, showering Earth with “shooting stars” or meteors (Wickramasinghe et al., 2010). The larger objects in the comet’s wake have a chance of landing on the Earth as meteorites, with only a thin outer layer being ablated such that the interior (and whatever is living inside) is preserved. This is exactly what happened in 1910 when the Earth passed through the tail of Halley's Comet. Millions of pieces of debris impacted the atmosphere, lighting up the skies with flashes of light, and showering the planet with tons of cometary debris. On average over 2 million pounds of cosmic dust falls to Earth every day (Wickramasinghe et al., 2010). Based on evidence reviewed by Joseph (2009c; Joseph and Schild 2010a,b) and Wickramasinghe (Wickramasinghe et al., 2010) if microbes are attached to this stellar debris, most would likely survive.

Figure 18. Comet Hale Bopp

The smaller sub-micron sized particles and any microbes and viral particles attached to them, do not burn up. Instead, they fall upon the upper atmosphere (the mesophere and stratosphere), and then slowly drift down and upon the air currents, sometimes staying aloft for years, crisscrossing the planet, gently falling downward, until finally making a soft landing on whatever is beneath them, be it ocean, river, animal, plant, or human (Wickramasinghe et al., 2010).

If bacteria and viruses are attached to these falling particles, then it could be surmised that as they descend through the air they may infect those hosts who are directly exposed and who inhale them (Hoyle and Wickramasinghe, 1979), beginning, perhaps with birds and flying insects.

Further, as they are caught up in the jet streams of the upper atmosphere, viruses and bacteria may be dispersed over wide areas of land and sea, triggering pockets of contagion which are separated by hundreds even thousands of miles. Comets may in fact be a source of diseases from space (Hoyle and Wickramasinghe, 1979), and once released into the upper atmosphere, microbes and viruses may be impacted by UV rays and cyclic changes in solar activity.

6. Influenza: A Space Virus?

Long before the viral cause of influenza was established, Physicians in the late 19th century asserted that epidemic influenza spreads so rapidly across the country that it defies explanation on the basis of person-to-person spread alone. The distinguished English Physician Charles Creighton described its spread as a miasma descending over the land.

In 1910, Halley's comet blazed across the skies, and 4 years later Europe was caught up in the fever of war. – and seven years later this *fever* became the Spanish flu - influenza pandemic. There is a wealth of information to be gleaned concerning the 1917-1919 pandemic if one has the patience to leaf through tomes of yellowing papers in the dusty archives of libraries. This is precisely the task that the late Fred Hoyle and Chandra Wickramasinghe undertook in 1978, examining sources that included *The London Times, Times of India, The Lancet* and US Senate Committee reports to name but a few. Their researches led to a stark, yet inescapable conclusion: at the very least some component of the infective agent responsible for the 1918-1919 outbreaks of a lethal brand of influenza fell directly from the skies (Hoyle and Wickramasinghe 1979).

Estimates of the death toll in 1918 vary from a minimum of 30 million to about twice that number (Barry 2005). There are some estimates that suggest that 20 million deaths occurred in India alone. In parts of Alaska and in the Pacific Islands over half the total population in some villages and cities had perished (Barry 2005). The rapid spread of influenza across the frozen wasteland of Alaska in November/December 1918 remains a mystery on the basis of person-to-person transmission. With a population of 50,000 people very thinly spread over an area of the size of Europe, and with ground transportation essentially impossible, the only route of viral transfer must have been through the air.

There were three waves of pandemic influenza occurring in less than 12 months (Barry 2005). In the first wave, which occurred in the spring of 1918 the attack rate was 50%, but the mortality rate was not high. The second wave, which came in the autumn, was characterised by high attack rates accompanied by very high mortality rates.

The overall scale of the disaster caused by the pandemic is difficult to imagine. Populations in many cities and villages were decimated in a matter of weeks. In the State of Punjab in India, streets were reported to have been strewn with corpses of victims, and at railway stations carriages had to be continually cleared of dead or dying passengers. The devastation in parts of the African continent were incalculable.

On the other hand some places miraculously escaped from the pandemic. St Helena, an island in the mid-Atlantic, is known to have definitely escaped, despite all the shipping that had called to port. Yet other areas separated by thousands of miles, including Boston and Bombay, were affected simultaneously.

Then there was a puzzling long delay before the pandemic reached the shores of Australia. This country seems to have been quite remarkably free of the disease until early in 1919, despite all the ships that called there from infected ports, and despite the well-attested attacks that occurred in mid-ocean. The first influenza death in Australia occurred at Sydney on 10 February 1919 and was reported in the *Times of London* of 20 February 1919.

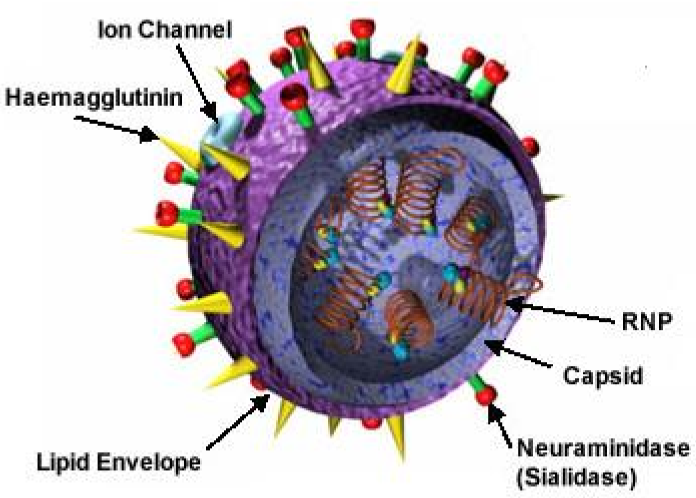
Again there was an enormous variability in the way ships at sea were affected. Passenger liners arriving in Australia during the pandemic recorded attack rates that ranged between 4% and 43%. And there were similar differences in the attack rates on crews of ships in the British Navy. In other words, the passengers and crews of many ships at sea, totally isolated from infected persons, quite suddenly were afflicted whereas others were spared.

The erratic behaviour of the influenza virus, particularly in the lethal second wave of 1918, is described graphically in an article by Dr. Louis Weinstein:

> “The lethal second wave, which started at Ford Devens in Ayer, Massachusetts, on September 12, 1918, involved almost the entire world over a very short time…..Its epidemiologic behaviour, was most unusual. Although person-to-person spread occurred in local areas, the disease appeared on the same day in widely separated parts of the world on the one hand, but, on the other, took days to weeks to spread relatively short distances. It was detected in Boston and Bombay on the same day, but took three weeks before it reached New York City, despite the fact that there was considerable travel between the two cities. It was present for the first time in Joliet in the State of Illinois four weeks after it was first detected in Chicago, the distance between those areas being only 38 miles…..”

The lethal second wave also provided striking evidence of local patchiness from one American city to another. Death rates from respiratory disease recorded in the late months of 1918 varied dramatically between different cities. A striking contrast came from Pittsburg and Toledo, neighbouring cities with normally almost identical death-rates and with populations engaged in similar daily occupations. The late 1918 death-rate from respiratory diseases in Pittsburg exceeded that in Toledo, not by a few percent or a few tens of percent, but by an enormous 400 percent.

The overall pattern of contagion is suggestive of a disease which is spread not just through the air, but the upper atmosphere, with diseased agents drifting along the jet stream and then literally falling from the sky. If correct, and if the pathogens originated in space, or were induced through upper atmosphere UV exposure, then it might be expected that genes might have been exchanged, and that high flying birds would have also been effected.



Figures 19 & 20. (Left) 1918 Flu Virus. (Right) 1918 Flu victim recovered from Alaskan permafrost.

In 2005, scientists from the Armed Forces Institute of Pathology in Washington, D.C., resurrected the 1918 virus from bodies that had been preserved in the permanently frozen soil of Alaska. They soon discovered that a completely new virus had combined with a old virus, exchanging and recombining genes, creating a hybrid that transformed mild strains of the flu virus into forms far more deadly and pathogenic. They also confirmed that the 1918 flu virus originated in the sky, first infecting birds and then spreading in humans.

7. Comet Encke and the 1918 Influenza Pandemic

There is no obvious link between the 1918 influenza pandemic and Halley's comet. In fact, a more likely candidate is Comet Encke which made extremely close approaches to Earth on June 16, 1908, and again on October 27 1914, and was at perihelion on 1918. And with each approach, Comet Encke shed ice, rock and dust which streaked through the atmosphere of Earth. There is some evidence to suggest that a large piece of Comet Encke broke off, fell to Earth, and exploded above the Tunguska, Russia, in 1908, leveling forests for hundreds of miles (Vaidya 2010).

Figure 21. Comet Encke. Photographed by the Spitzer Space Telescope, NASA, JPL-Caltech.

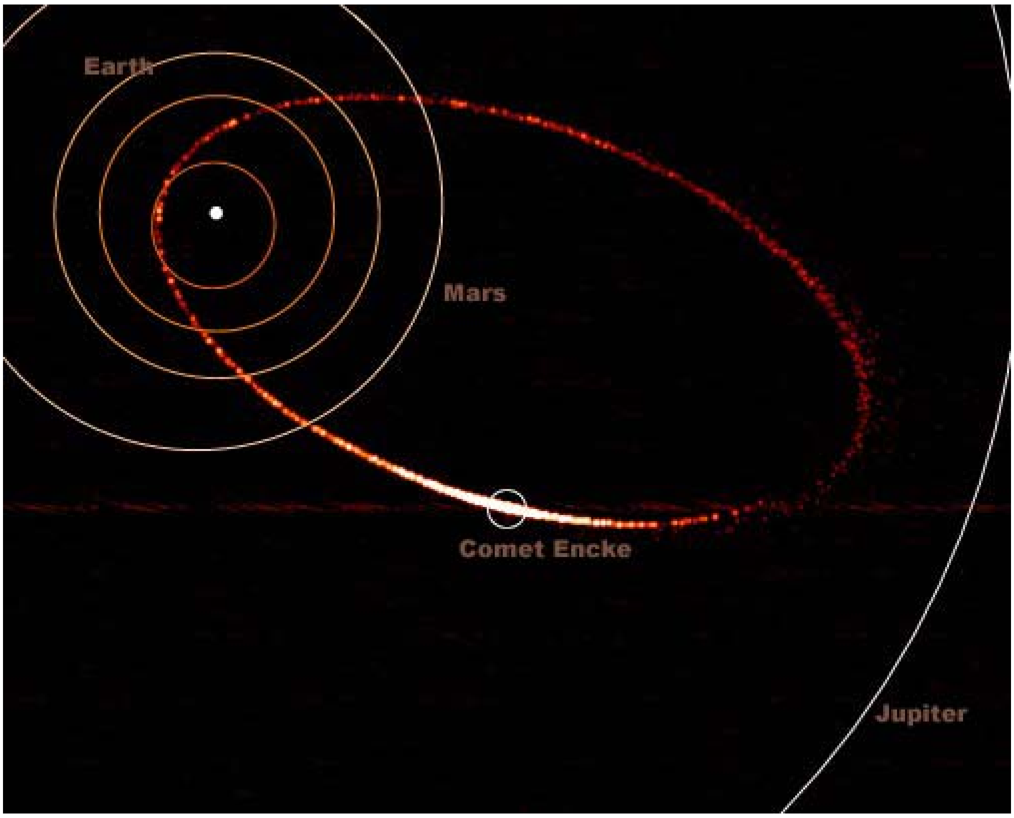


Figure 22. Comet Encke orbit and dust trail.

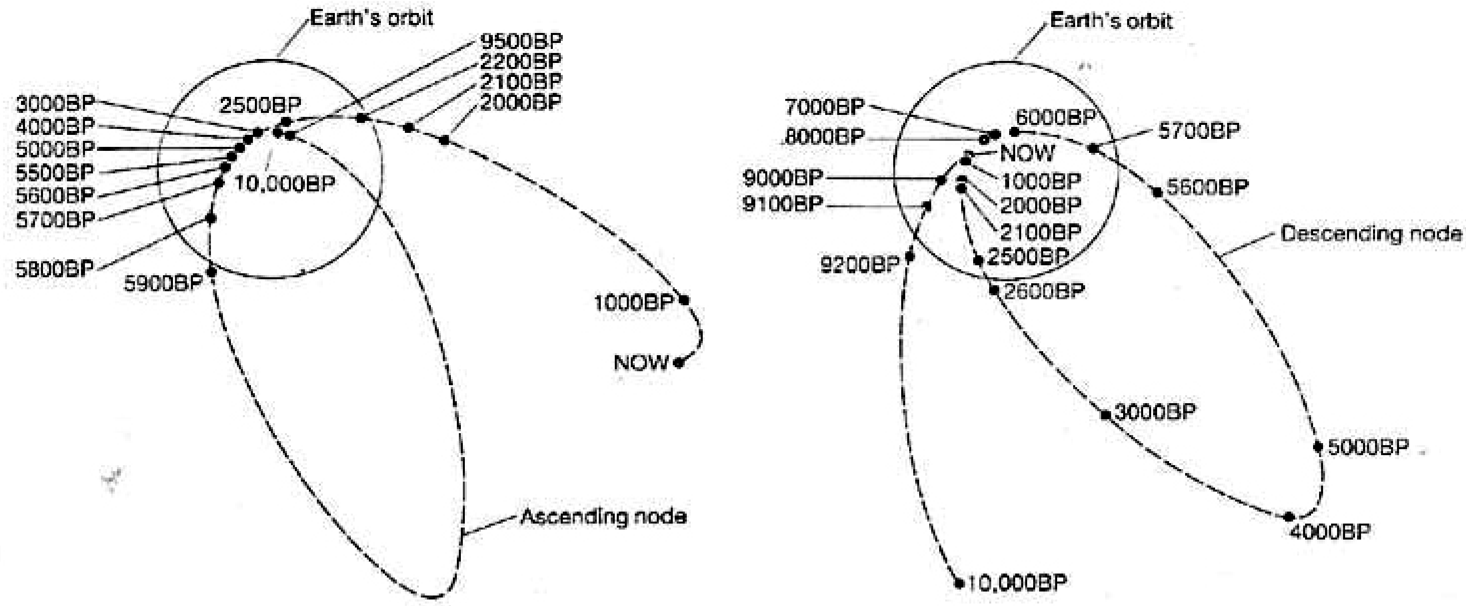


Figure 23. Intersection points (nodes) of Comet Encke's orbit with Earth's orbit, at various dates before the present (BP). The orbit of the comet and its associated tail has intersected that of the Earth repeatedly throughout history.

There is as yet no way to determine if a comet played a role in the plague of 1918. However, it is now known that this epidemic began in birds which were the first to die, infected with some mysterious disease that fell from the sky.

8. H1N1 and The Avian Flu

On April 20th, 2007 comet Encke was struck by a mass of material blasted from the corona of the sun which was so powerful it broke off the comet's tail and swept it away into deep space. In late June and early July and again in November of that year pieces of comet Encke rained down upon Earth.

The burst of solar activity would have also impacted life on Earth, most notably microbes in the upper atmosphere, and those lofted above the UV-screening ozone layer. As detailed by Wainwright et al. (2010), some of these high altitude microbes could be exposed to mutation-inducing UV rays; a possibility which becomes even more likely considering the increased solar activity at this time. However, even microbes in the lower atmosphere may be impacted during periods of increased solar activity. Thus, be it microbes and viruses released form comet Encke, or mutations triggered in the upper atmosphere, if either of these scenarios took place, disease and plague might be the expected outcome.

In the Spring of 2009 a new viral infection began to spread among humans separated by vast distances from one another. On June 11, 2009, the World Health Organization declared the onset of a new pandemic: H1N1, the "swine flu." However, the virus was genetically unique, as its genome consisted of pig genes, human genes, and bird genes. Further, it was attacking in waves.

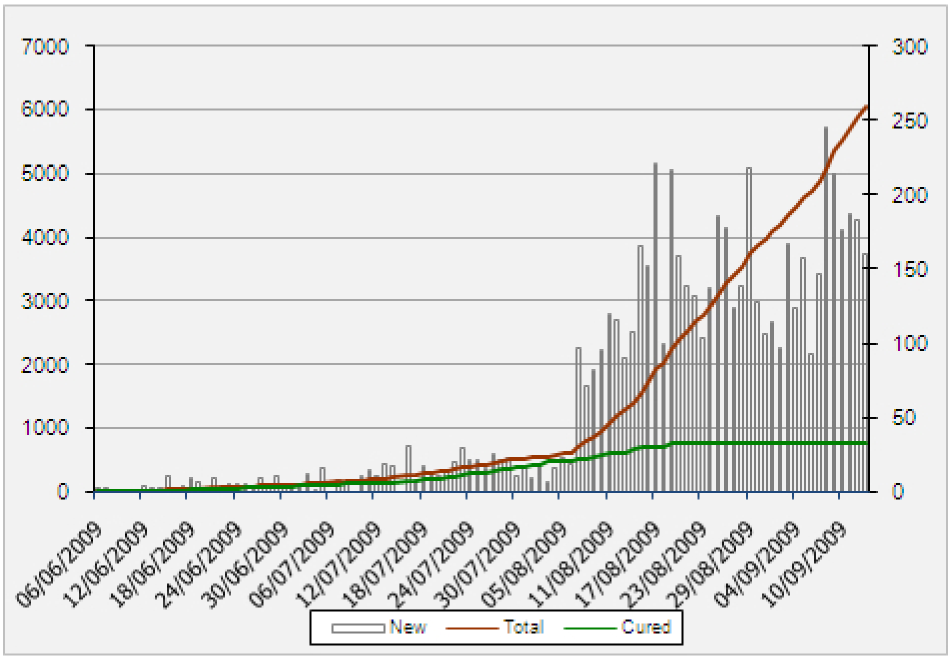


Figure 24. H1N1 Flu epidemic

Is it a coincidence that the infective period of 2009-2010 is linked to passage of comet Encke and the highest peak of sunspot activity for decades? Previous connections have been noticed between peaks of solar activity and the emergence of new pandemic strains. The link between Encke and pandemic of 1918 and that of other comets and plague, have already been noted.

Like the flu pandemic of 1918, the Swine flu of 2009-2010, also has a genetic link to the sky, i.e. birds. Moreover, H1N1, is now believed to be a subtype of the avian flu which first began to infect humans in 1997. Avian flu, however, normally does not target or sicken humans, unless there is direct exposure to a sick bird. Thus, something occurred between 1997 and 2009, which induced the creation of a virus with a unique genome and variations thereof (e.g., H1N2, H3N2, H5N1) which could selectively target humans.

The possibility that these viruses have as their source an external reservoir of the viruses in the high atmosphere which fell from space, and which were amplified by the exudations of high-flying migratory birds, cannot be ignored, no matter how unlikely it might sound. Winter downdrafts could bring down the amplified virus as nuclei of mist that can directly enter the respiratory tracts of susceptible humans. A heavy fall-out in any location could give a semblance of high infectivity.

A similar pattern of erratic incidence was recorded by Hoyle and Wickramasinghe in their study of the H1N1 (red flu) pandemic of 1976. This subtype of influenza was not in circulation for over 20 years, so its re-emergence as a pandemic strain gave them an opportunity to consider school children with virgin immunities as detectors of the virus. Their results for the exceedingly variable attack rates in schools (eg Eton College, a famous boarding school near Windsor) showed patchiness of incidence of the virus on the scale of separation between houses. This is seen in Figure 25.

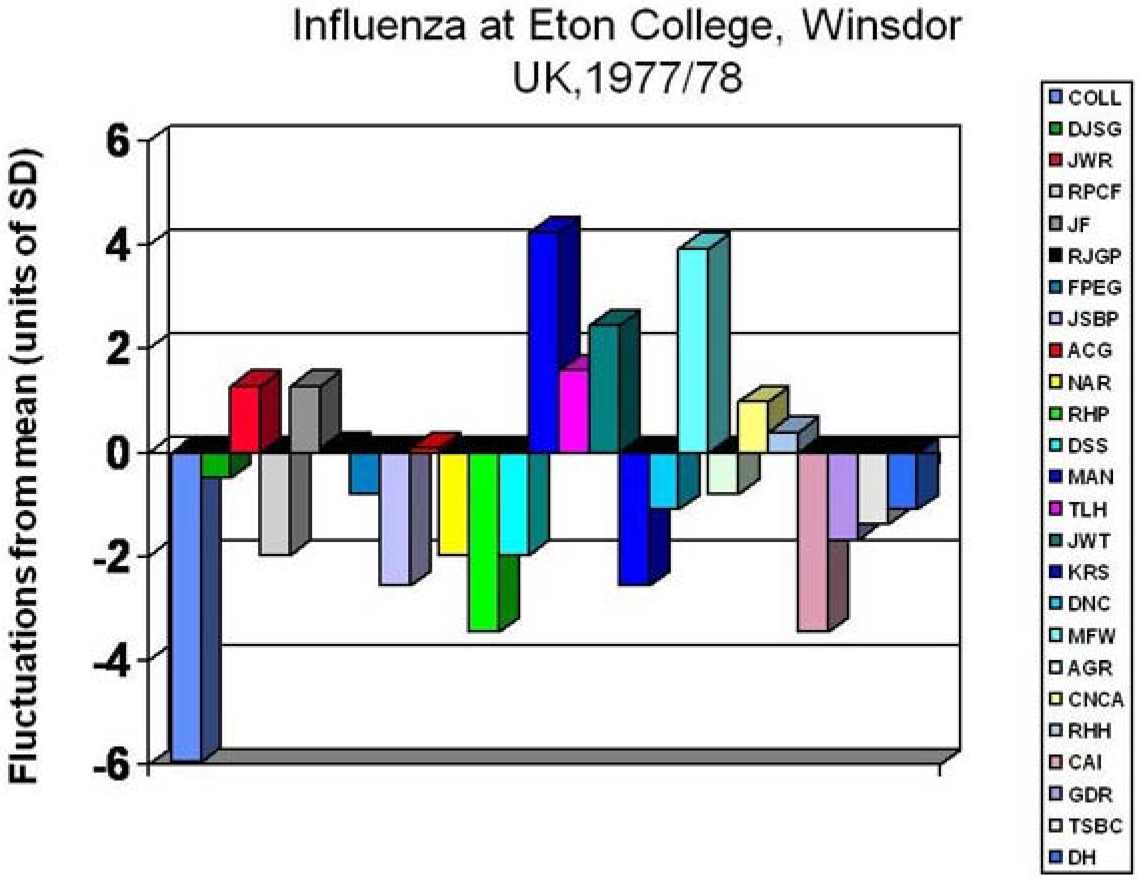


Figure 25. Fluctuation in attack rates from house to house, in terms of a sample standard deviation. This distribution arises with a probability of less than 1 in 1010 if person to person transmission took place.

9. Evolution vs Disease

In terms of total biomass, bacteria are the dominant species on this planet. Viruses accompany bacteria and archae, but outnumber them by ratios of up to 100 to 1 (reviewed in Joseph 2009a,b). On a world which is overrun by bacteria and viruses, and given the proliferation of life on this planet, it is thus evident that viruses and bacteria sicken and kill only rarely. In fact archae, bacteria and viruses have donated to the eukaryotic genome many of the core genes which made evolution and speciation possible (Joseph 2009a,b), wheras viruses often provide substantial benefits to the host and are often subverted by the host for its benefit (Lorenc and Makalowski. 2003; Miller et al., 1999; Parseval and Heidmann 2005).

Thus, viruses do not generally sicken the host, but provide benefits to the host. Moreover, they insert genes and regulatory elements into the host genome and have played an active role in evolution leading to humans (Joseph 2009a,b).

Viral genes and viral elements encompass 42.2% of the human genome and almost half of the mammalian genome (Deininger and Batzer 2002; van de Lagemaat et al. 2003). The human genome contains 200,000 copies of endogenous retroviruses grouped in three classes (Lander et al. 2001), which have been introduced through at least 31 infection events (Belshaw et al. 2005); each infection event however, required that a specific host first evolve, and previous infectious events are associated with the evolution of a host which was then targeted by other viruses.

Endogenous retroviruses were inserted into the primate genome tens of millions of years ago, and then activated or silenced at key points of evolutionary divergence, such as the split between new world and old world monkeys, and the split between hominids and chimpanzees (López-Sánchez et al., 2005; Romano et al., 2007). Presumably, these viral genes triggered species divergence and promoted the evolutionary progression leading to humans (Joseph 2009a,b). Once humans evolved, additional waves of viruses were unleashed.

The defining feature of Viruses including retroviruses, is they precisely target specific species and host cells. They maintain a "lock and key" relationship with specific hosts. Further, the ease at insertion and integration, indicates that the viral RNA or DNA genome is a perfect fit and thus genetically identical to the genome of the targeted host. This is why viral genes can also regulate gene expression in the host and which are of benefit to the host. As these viral agents must have existed prior to the evolution of their Earthly hosts, then they must have obtained these RNA DNA-templates from identical hosts which must have existed on other planets, probably through horizontal gene exchange exactly as takes place on Earth (Joseph 2009a,b; Joseph and Schild 2010a). The only other explanation is "coincidence."

Those who advocate an Earth-centered abiogenesis and those advocating panspermia as the source of life on Earth, generally agree that the first archae and bacteria to take root on this planet, triggered the evolution of multi-cellular eukaryotes by transferring, into single celled eukaryotes (or a proto-eukarote) exons, introns, transposable elements, informational and operational genes, RNA, ribozomes, mitochondria, and the core genetic machinery for translating, expressing, and repeatedly duplicating genes and the entire eukaryotic genome (reviewed by Joseph 2009a,b). Therefore, it can also be reasoned that if life arose on other planets secondary to panspermia or abiogenesis, the same genetic fusion may have taken place on Earth-like worlds, such that complex eukaryotic organisms would have also evolved (Joseph 2010, Joseph and Schild 2010a,b).

According to the complex genetic models of panspermia developed by Joseph (2000, 2009a,b,d; Joseph and Schild 2010a), viruses and microbes may be cast into space by powerful solar winds, through bolide impact, and may hitch a ride to other planets inside meteors, asteroids, and comets. Once they come into contact with life forms dwelling on these other worlds, they acquire and donate genes through horizontal gene transfer exactly as takes place on Earth. As many (if not all) of these extra-terretrial life forms may be linked to the same ancestors who may have been first fashioned over 10 billion years ago (Gibson and Wickramasinghe 2010; Joseph 2010; Joseph and Schild 2010a,b; Napier and Wickramasinghe 2010) and thus possess the same "universal genetic code", horizontal gene transfer would be a common means of exchanging genes, with viruses acting as genetic storehouses. Thus, when ejected into space, viruses, bacteria, and archae, carry within their genomes vast arrays of genes, some of which can be inserted into hosts dwelling on one planet who are essentially identical to hosts living on other worlds (Joseph 2000, 2009b,c; Joseph and Schild 2010a). This would explain not just the perfect Virus-host match and the ease of viral DNA insertion into specific hosts after they evolve, but the fact that these inserted genes often interact smoothly with a network of host genes, often to benefit the host, and act to purposefully increase and promote speciation and evolution (Joseph 2009a,b).

This also explains why the virus acts purposefully, targeting and inserting its RNA or DNA into specific hosts where there is a perfect genetic match. However, when there is a slight mismatch (or due to UV or other genetic damage), *errors* are introduced into the genome, and the host sickens and may die (Hoyle and Wickramasinghe 1979; Joseph 2009a,b,d). This would explain why viruses and bacteria seldom induce disease, despite their prevalence on this planet.

It may also be, however, that just as viruses and prokaryotes have contributed genes which promoted the health and evolution of increasingly complex species (Joseph 2000, 2009a,b), that they have also been genetically programed to eradicate competing species. Joseph (2009d) refers to this as programmed genetic apoptosis, such that species are shed and become extinct whereas others emerge in bursts of speciation. Consider again the demise of the dinosaurs, with the *coupe de grace* possibly administered by pathogens (Poinar and Poinar 2007), which may have been dispersed and released when the Chicxulub asteroid collided with Earth. Dinosaur extinction made possible the evolution of mammals leading to humans; and this evolutionary progression was guided by a series of infective events and the insertion of viral and bacteria genes which are an integral part and still active within the human genome.

However, if viruses and bacteria obtained some of these genes from extra-terrestrial hosts, then how did these viruses and bacteria (or their descendants) come to infect the humans of Earth? Of the various mechanisms of panspermia responsible for transporting life throughout the cosmos (Joseph and Schild 2010a; Napier and Wickramasinghe 2010), comets would most likely serve as a primary means of continual contamination (Hoyle and Wickramasinghe 1979; Wickramasinghe et al., 2010).

10. Comets: Origin and Contagion

The processes that led to the formation of comets, now mostly occupying the Oort cloud at an average distance of 0.3 light years from the sun, is still in dispute. In the most popular theory, comets represent cold accumulations of interstellar gas and dust that formed in the protosolar nebula and included radioactive nuclides. Comets could also consist of frozen pieces of fragmented primordial planets (Gibson and Wickramasinghe 2010) or shattered remnants of rogue planets ejected from dying solar systems during their sun's red giant phase (Joseph and Schild 2010). Moreover, they may form which stellar objects strike the oceans of "water worlds" thus casting millions of gallons of water into space which might freeze along with any organisms which had also been splashed into space. Regardless of scenario, a population of microorganisms may be supposed be have been included, and these would replicate exponentially on very short timescales; or they might immediately forms spores and become dormant. The warm liquid interiors of primitive comets would offer a habitable environment for innumerable microbes, particularly archae, and perhaps even a few complex species (Napier and Wickramasinghe 2010; Wickramasinghe et al., 2010).

Archae differ from bacteria in regard to cell wall composition, and coenzymes, and they can adapt to extremes in temperature, salinity, and oxygen. They can live in permafrost if hydrogen is present as well as ammonia or nitrates and in the absence of organic material or oyxgen (reviewed by Joseph 2009a,b). Some would flourish deep within the primitive comet's core, an environment which might be much warmer than the surroundings (Hoyle and Wickramasinghe 1985; Napier et al., 2007; Wickramasinghe et al., 2010). Others would become dormant, frozen in ice, awaiting only a change in the environment to awake, for in fact this is exactly what occurs on Earth (Gilichinsky 2002; Rivikina et al. 1998).

11. Comets and Meteorites

Since comets lose mass (mainly in the form of volatiles) with every perihelion passage, they decrease in size and eventually end up as the parent bodies of asteroids and finally carbonaceous meteorites (Wickramasinghe et al., 2010). These so-called carbonaceous chondrites have retained mainly the mineral component of the original comets, but with organic residues trapped in their interstitial spaces. Since we think the comet originally harboured microbial life which may have flourished and replicated for millions of years, the residue in the form of the meteorite would be expected to contain evidence of bacteria and viruses in a fossilised form. This has indeed been discovered. The first reliable detection of such microscopic fossils in the Murchision meteorite was reported by Pflug (1984) and Pflug and Heinz (1997), with images such as are reproduced in Figure 26. Furthermore, viral particles have been recovered (Pflug 1984). This work has recently been confirmed and extended by Richard Hoover (2005, 2006).

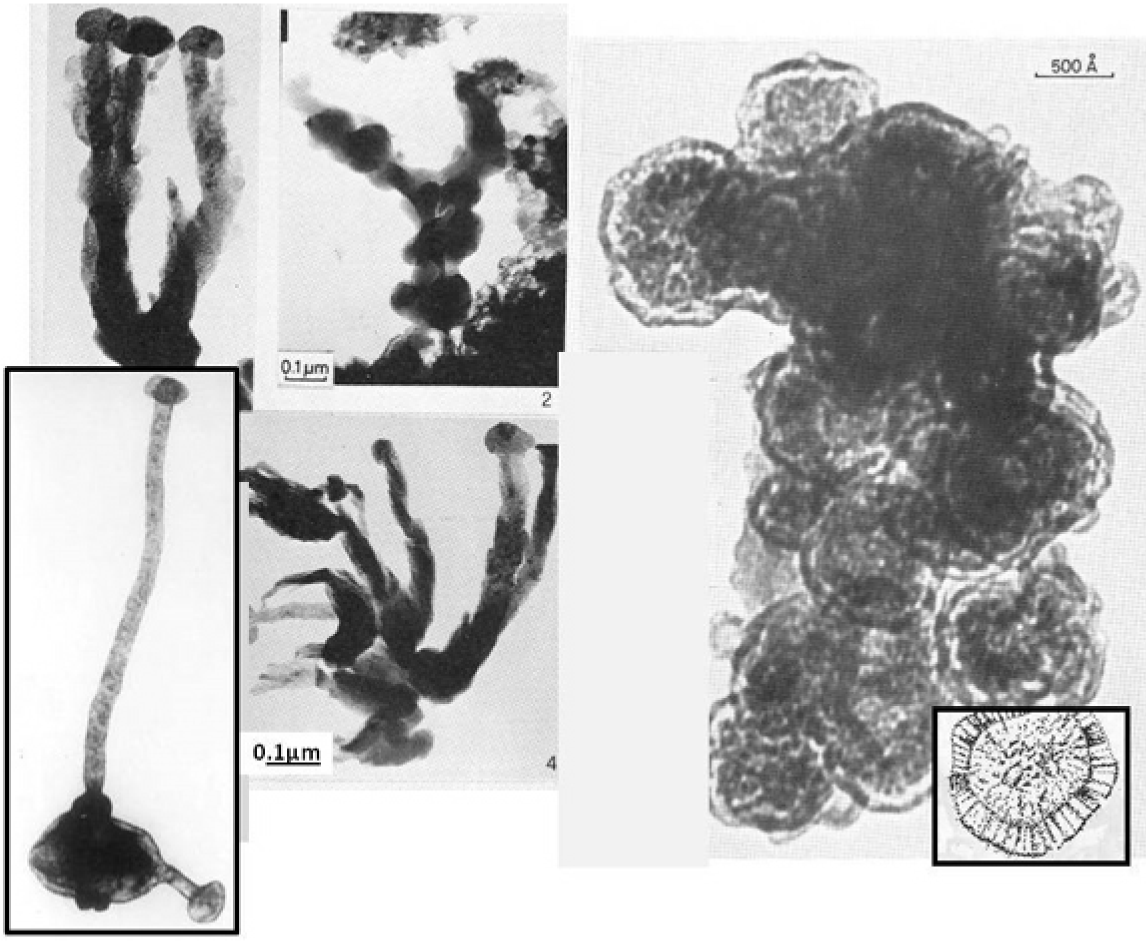


Figure 26. (Left) The comparison of a characteristically biological structure in the Murchison meteorite with a similar structure corresponding to a modern iron-oxidising microorganism – pedomicrobium. (Right) An electron micrograph of a structure resembling a clump of viruses – influenza virus – also found in the Murchison meteorite. The drawing in the inset is a representation of a modern influenza virus displaying astounding similarities in structure to the putative clump of fossil viruses.

12. Life Within Ice

When the radioactive heat sources in primordial comets become exhausted, typically on timescales of millions of years, an initial microbial population would have evolved, diversified and become vastly amplified. At later times the average temperature within the comet would be ~ 100K or less, so no metabolism might be possible (as microbes would become dormant and form spores), except for brief periods when comets approach perihelion, and temperatures below the surface permit transient melting of the ices. However, for larger frozen comets or planets of radii >300km, longer lived radioactive nuclides could preserve interior liquid domains over billions of years. Furthermore it is possible that the operation of biology itself would contribute to a heat-source, thus keeping temperatures close to the triple point of water.

What sort of creatures could survive subzero temperatures? Trillions, including what are called "extremophiles." Bacteria such as M. Frigidum prefer ice cold enviornments, and a variety of microbes have been discovered living in the frozen ice of Antarctica, including at Lake Vostok. Microbes hae been recovered from ice cores up to 400 m deep in the Canadian arctic and at ground temperatures of -27 C in the Antarctica. Some of the cells date back to 3 million years. Even older cells have been found in the Antarctica and upon thawing renewed their physiological activity (reviewed by Gilichinsky 2002).

Richard Hoover (2005, 2006), discovered fungi, algae, cyanobacteria, nanobacteria, spores, diatoms, and protozoan in deep ancient ice cores over 4,000 years old, drilled from Lake Vostok, near the south pole. These creatures were found in association with ancient cosmic dust particles which had fallen from space. Moreover, microbes recovered from Lake Vostok increase in number with increasing numbers of cosmic dust particles which fell to Earth from space (Abyzov et al., 1998).

Hundreds of complex species lay dormant, frozen in the ice, and deep within permafrost, only to awaken with the Spring thaws. In fact, "permafrost can maintain life incomparably longer than any other known habitats (Gilichinsky 2002).

Microbes which flourish in the cold are this planets most successful colonizers. In fact, microbes dwelling in permafrost have a total biomass many times higher than those living in soil. Eukaryotic cells are also found in permafrost (Vishnivetskaya et al. 1997). Algae, mosses, viable seeds, and a variety of plants such as lichens and snow bells can live and even blossom while buried for months beneath snow and ice. Complex animals and plants thrive in subzero temperatures 4 miles beneath the frigid antarctic ocean, at the bottom of the sea, under thousands of pounds of crushing, ice-cold ocean weight. Therefore, it could be surmised that perhaps even simple eukaryotes could survive within the hearts of comets.

However, in contrast to complex animals and plants, microbes can survive frozen, deep within the permafrost for millions of years (Rivikina, et al., 1998). Moreover, microbes which form spores in frozen conditions and might live for billions of years (Gilichinsky 2002). In fact they are perfectly adapted for a life on some frozen astral object, traveling through space. "The long term impact of subzero temperaturs should be regarded not as extreme and limiting but rather as a stabilizing factor supporting the viabilty of microorganisms" (Gilichinsky 2002).

13. Conclusions

Correlation is not causation and thus no firm conclusions can be draw, despite the wealth of evidence suggesting a link between comets and diseases from space. Nevertheless, comets are an ideal vehicle for sustaining and transporting a variety of microbes, including viruses, from planet to planet and even from solar system to solar system. In consequence, when these organisms are deposited on a world already thriving with life, genes may be exchanged, the evolution of new species may ensue, or conversely contagion may be unleashed, and disease, death, and plague may spread throughout the land.

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