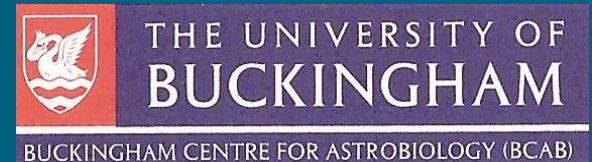


Discovery of Extraterrestrial Life - Impact on Humanity

Chandra Wickramasinghe
Gensuke Tokoro
Milton Wainwright



- To our stone-age ancestors who constructed these stupendous monuments, the sun, moon and celestial bodies were divinities
- To them a connection with the external cosmos was obvious and inevitable





The connection is depicted in extant cave paintings (Pleiades and the Constellation Taurus in Lascaux cave in France - 16500-13000 BC)

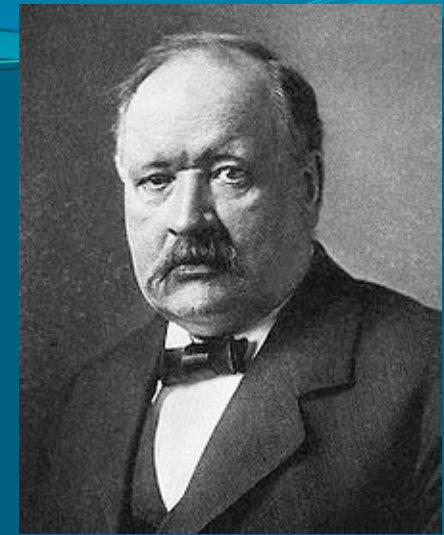
And this continued into modern art as seen in Paul Gauguin's 1897 painting with the title: "Where do we come from? What are we? Where are we going?"



The gaze up to the skies tells it all.....

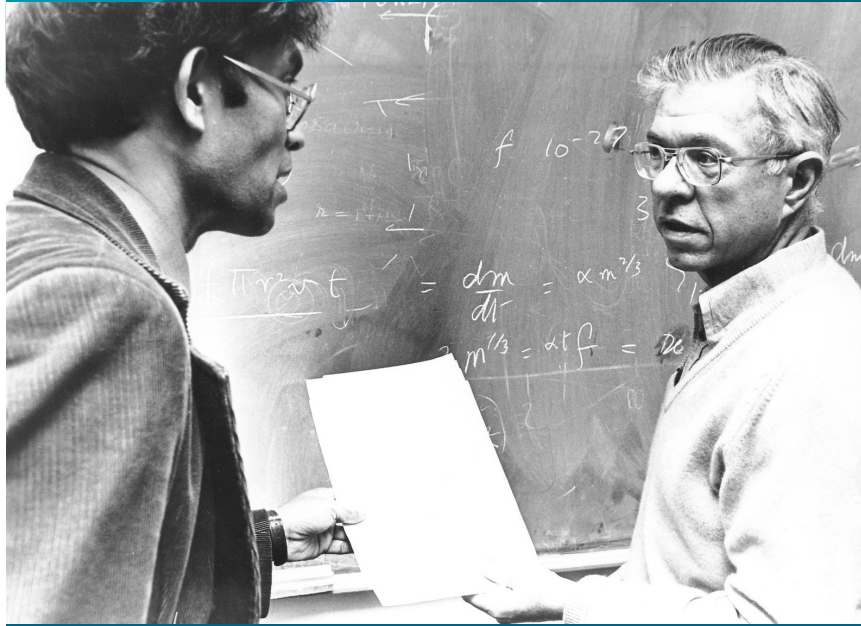
- The process of relinquishing our ancient cosmic connection began after the publication of Darwin's "*Origins of Species.....*" in 1857
- The deeply entrenched scientific position for the past century has been that life is essentially Earth-centred and arose in "some warm little pond" on Earth



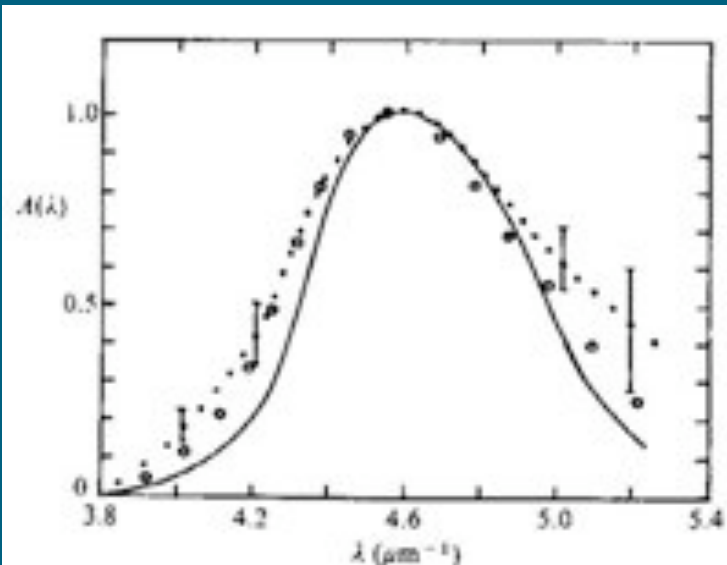


The ancient idea of *panspermia* due to the Greek philosopher Aristarchus of Samos (310-230BC) –was revived by Svante Arrhenius in 1908

Arrhenius was soon put in his place by his opponents who declared that microbes do not survive the rigours of space



In 1977 Hoyle and I published a paper entitled “Identification of the $\lambda 2200\text{\AA}$ interstellar absorption feature” (Nature, 270,323) + 11 other papers in Nature



We were the first to assign this feature to biologically relevant molecules

W.W. Duley and D.A. Williams
wrote in *Nature*:

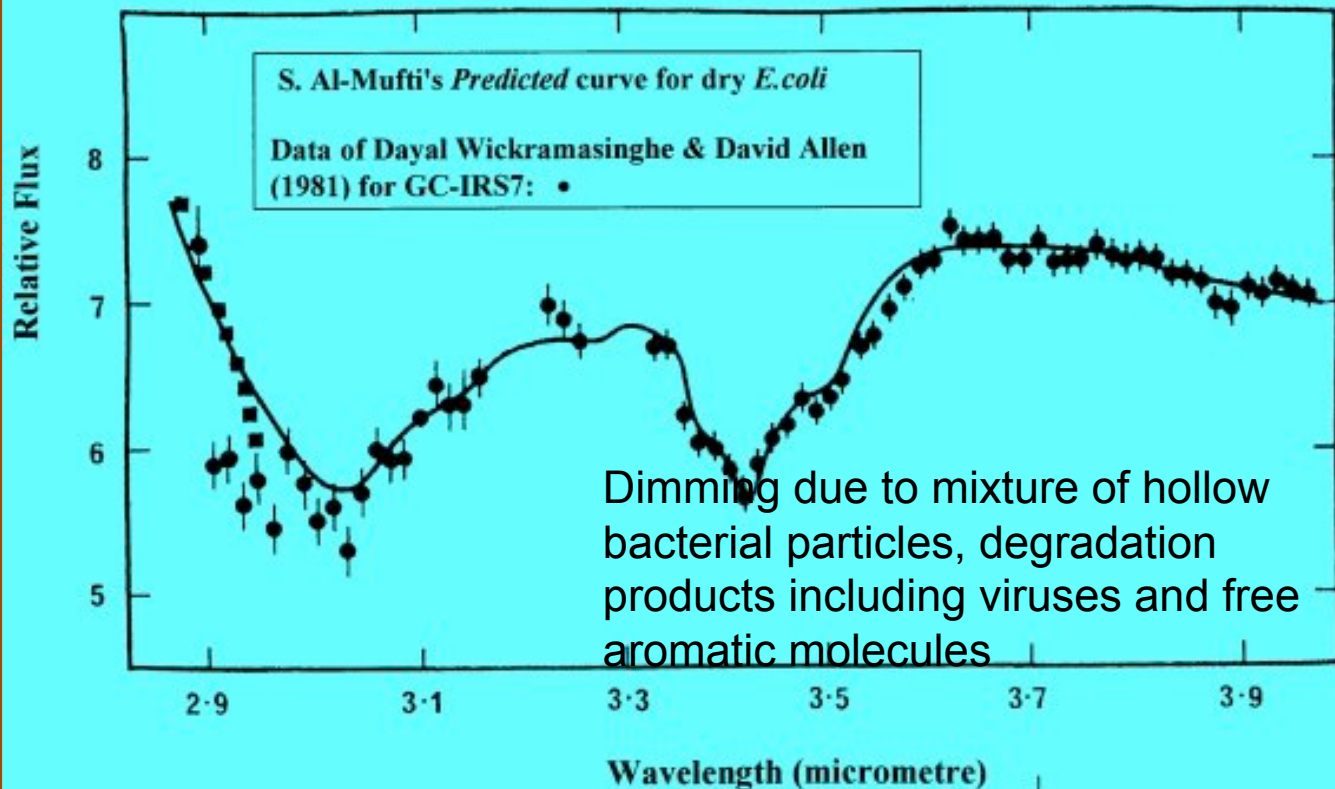


“....We conclude that no spectroscopic evidence exists to support the contention that much of the interstellar dust consists of organic materials.....”

Nature, 277, 4 January 1979.

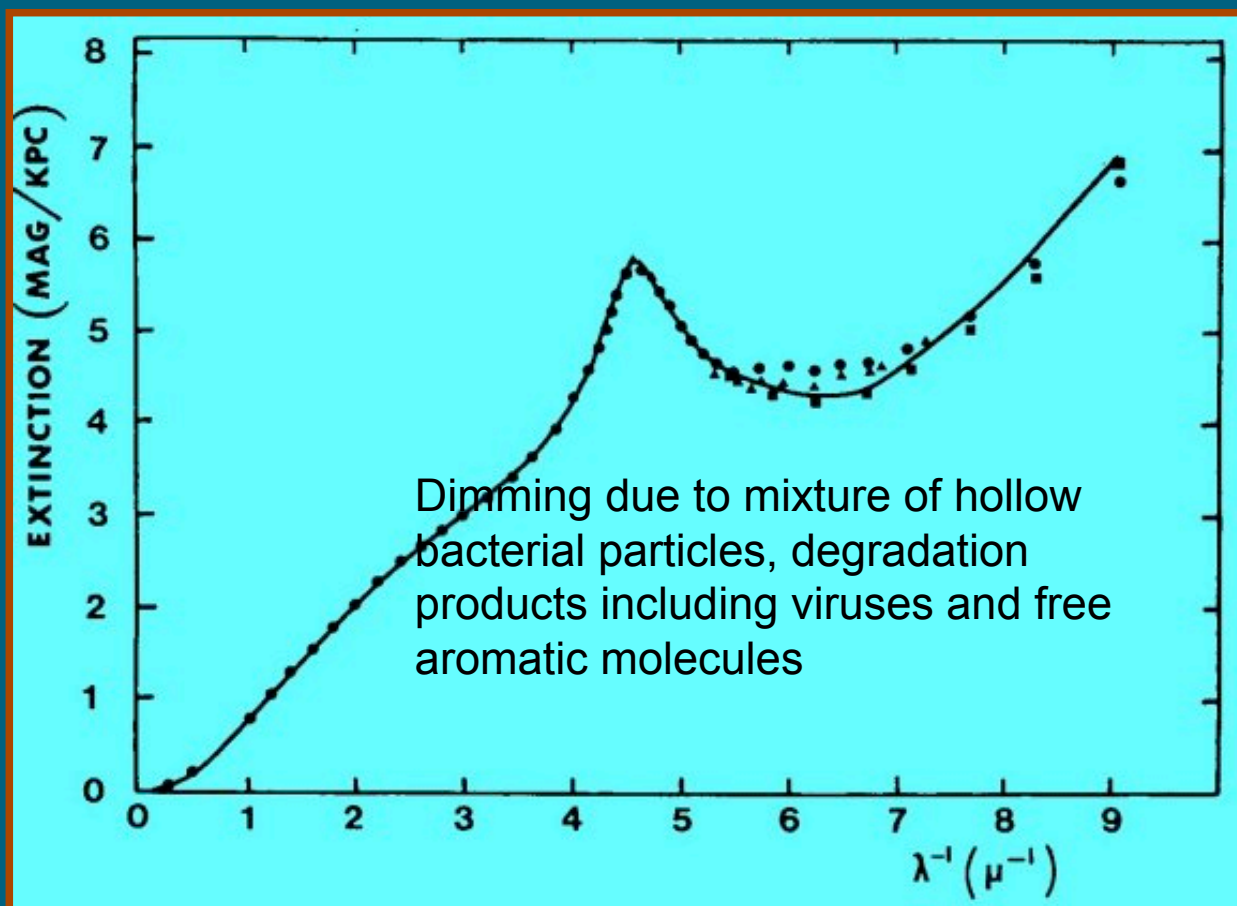
Such strident denials continued until the mid 1990's.....

In 1982 a comparison of the spectrum of interstellar dust with *E. coli* showed striking similarities

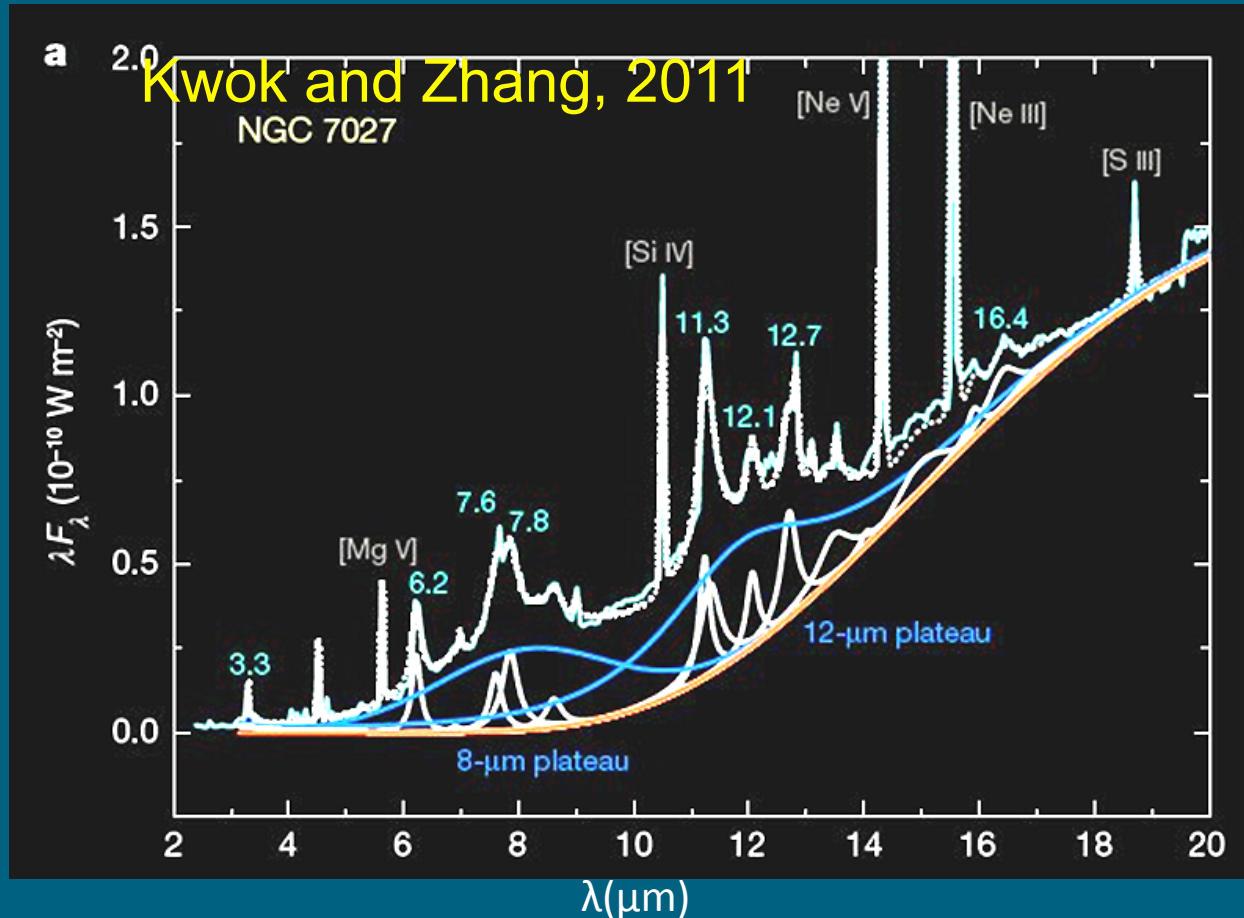


***Implies:
1 carbon
atom in
3 is tied
up in
this
form***

Our position in regard to the abundance of interstellar organics was amply vindicated as new techniques gave more data relating to interstellar dust

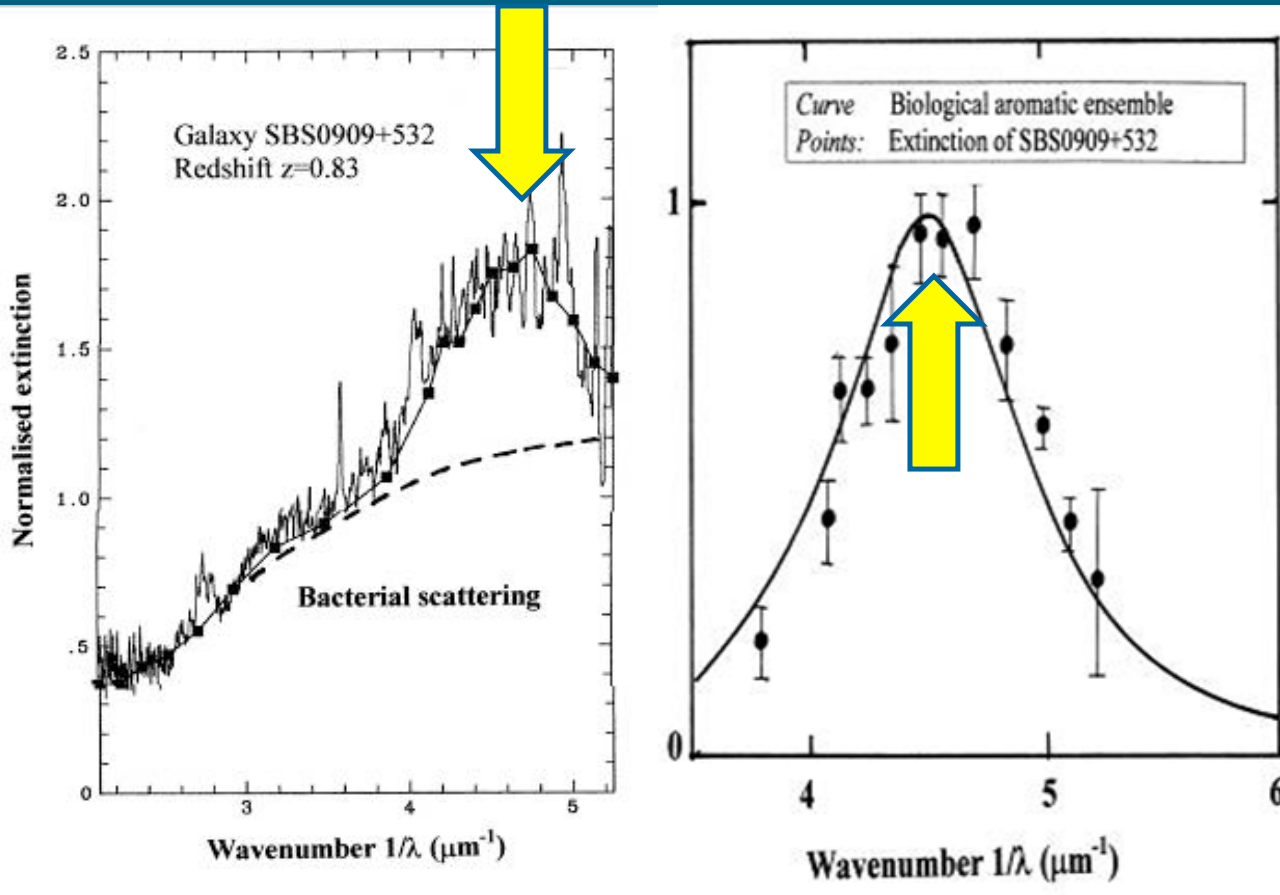


Absorptions identified with biomolecules are now found everywhere in the galaxy

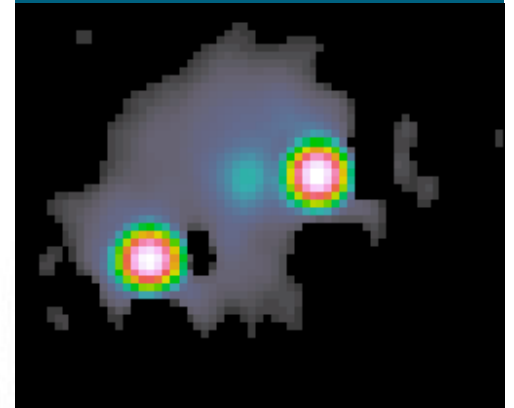


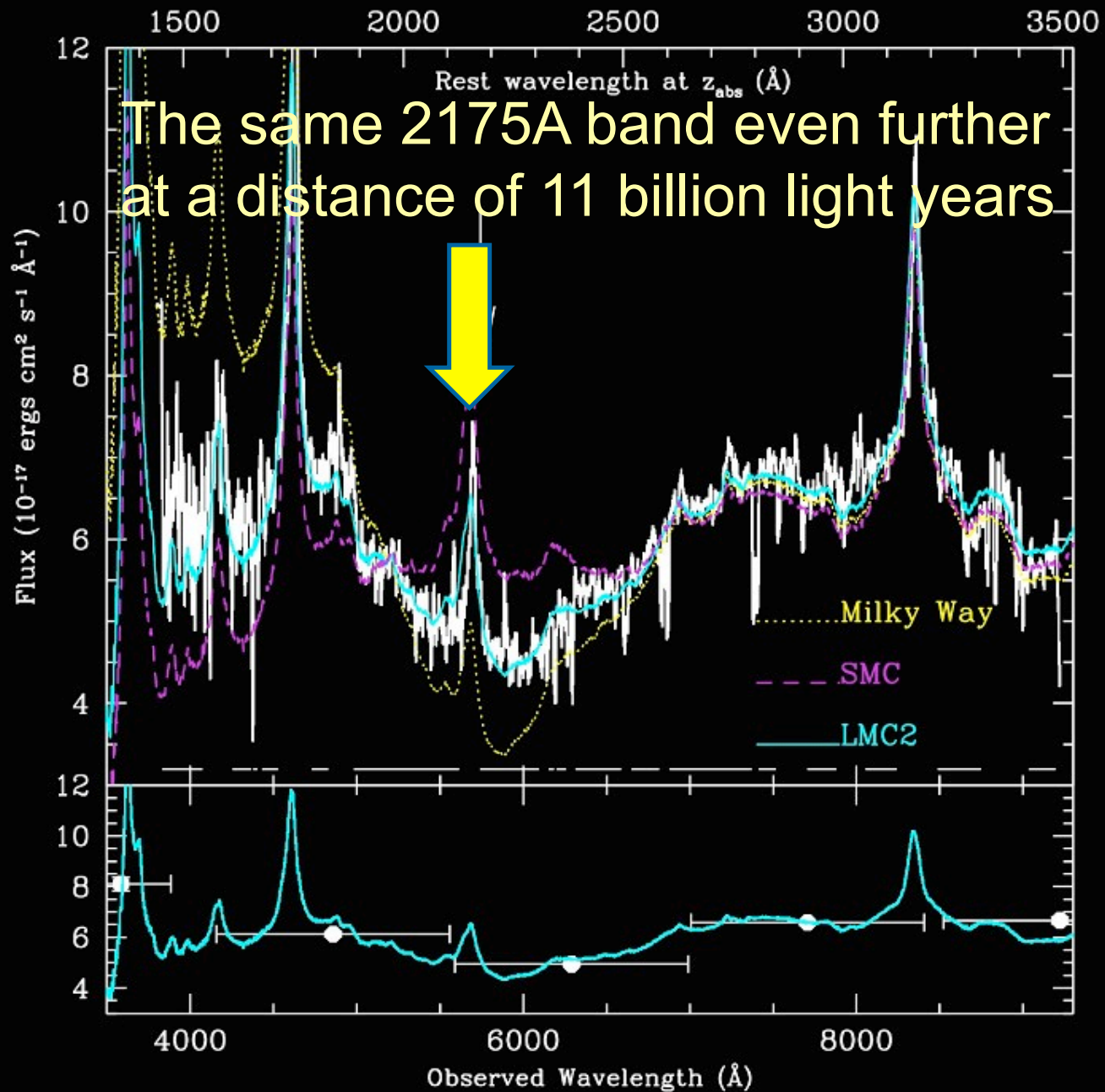
NGC7027, NGC 2023	3.3 3.4	6.2 7.7 8.8 11.3
Mixture of 115 biomolecules	2.9 3.3 3.4 5.25	6.2 7.7 8.8 11.3

An absorption signature of dust at 2175Å, similar to biological aromatics, was discovered at a distance of **nearly 8 billion light years**



SBS 0909+532





Infrared, ultraviolet and visual
extinction/emission data

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graph TD; A["Infrared, ultraviolet and visual  
extinction/emission data"] --> B["Huge quantities of exceedingly complex organic  
chemicals in ISM (~10% of interstellar carbon)  
have to be explained"]; B --> C["Break-up of cells"]; B --> D["Build-up from atoms"];
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Huge quantities of exceedingly complex organic
chemicals in ISM (~10% of interstellar carbon)
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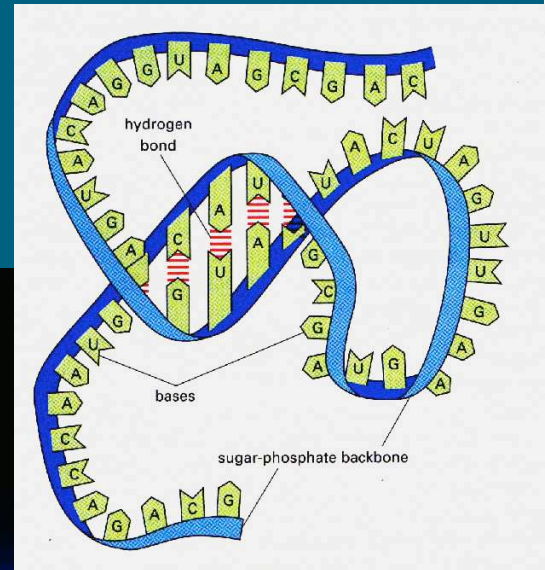
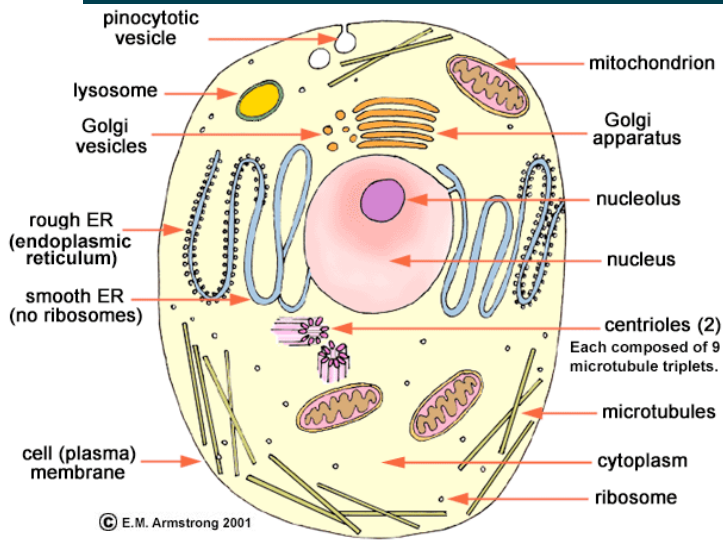
Break-up of cells

Build-up from
atoms

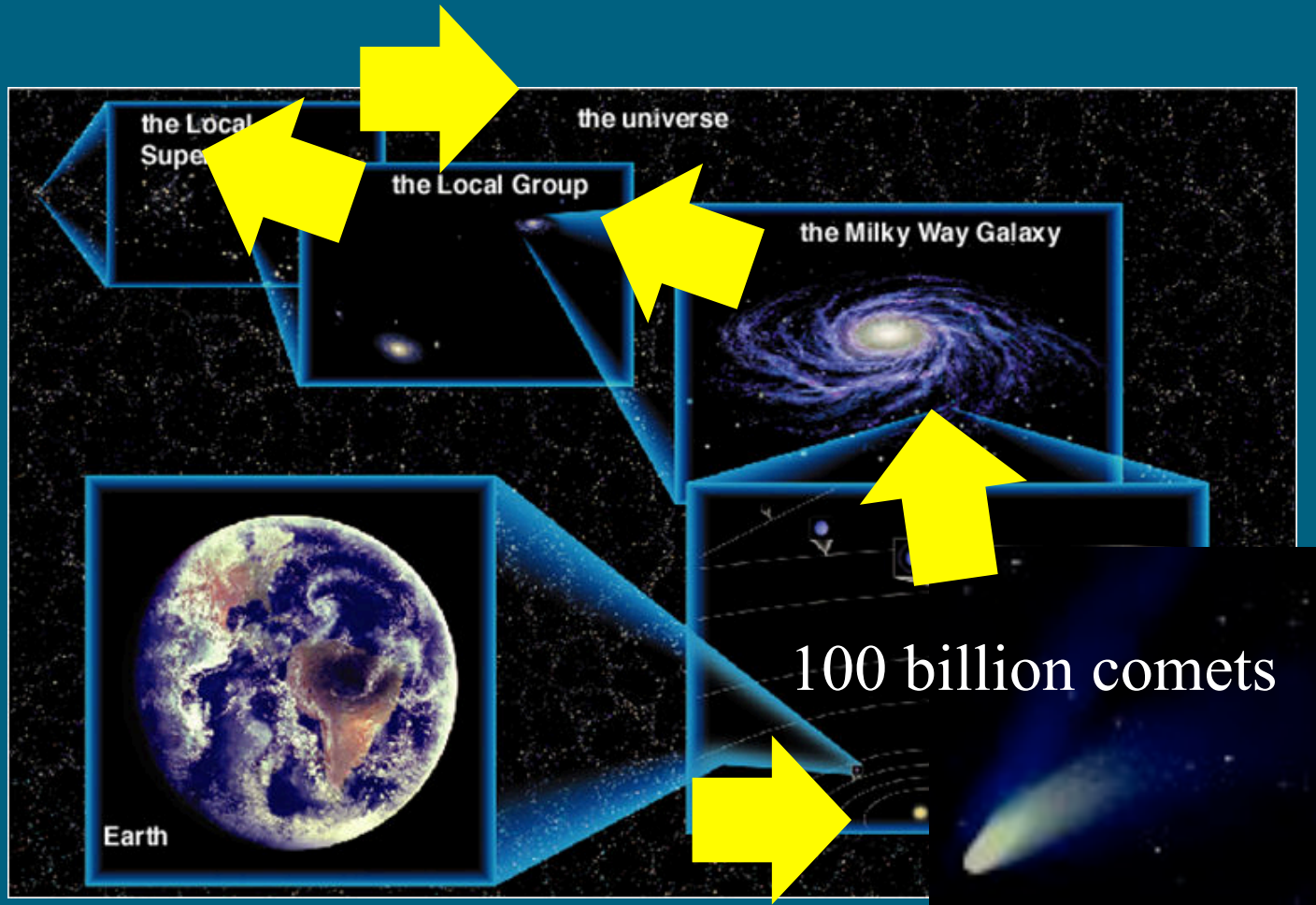


Break-up of living cells, producing the whole range of interstellar organics molecular fragments is by far the more plausible!

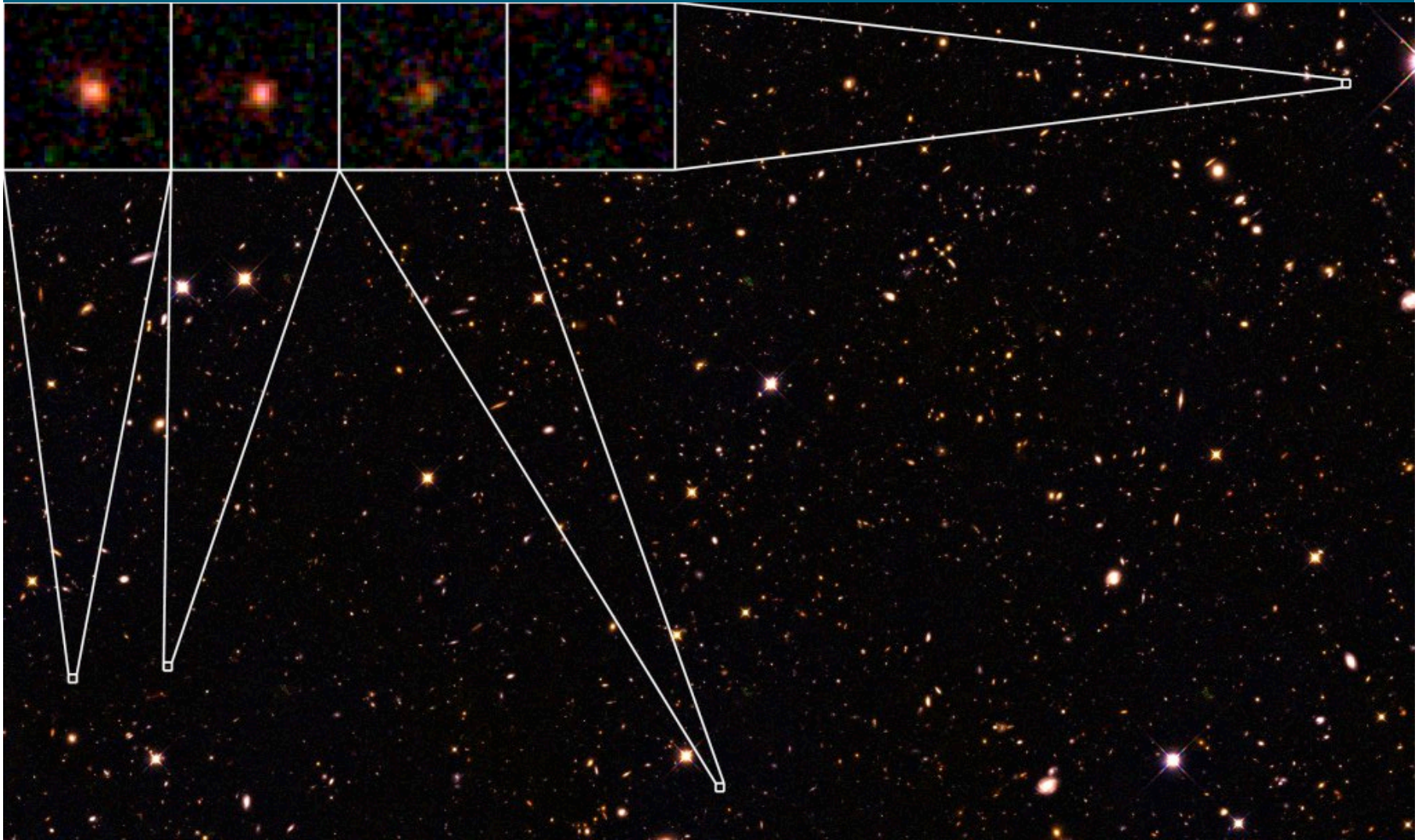
....more plausible than beating the minuscule odds of assembling even the simplest microbe from its component momomers

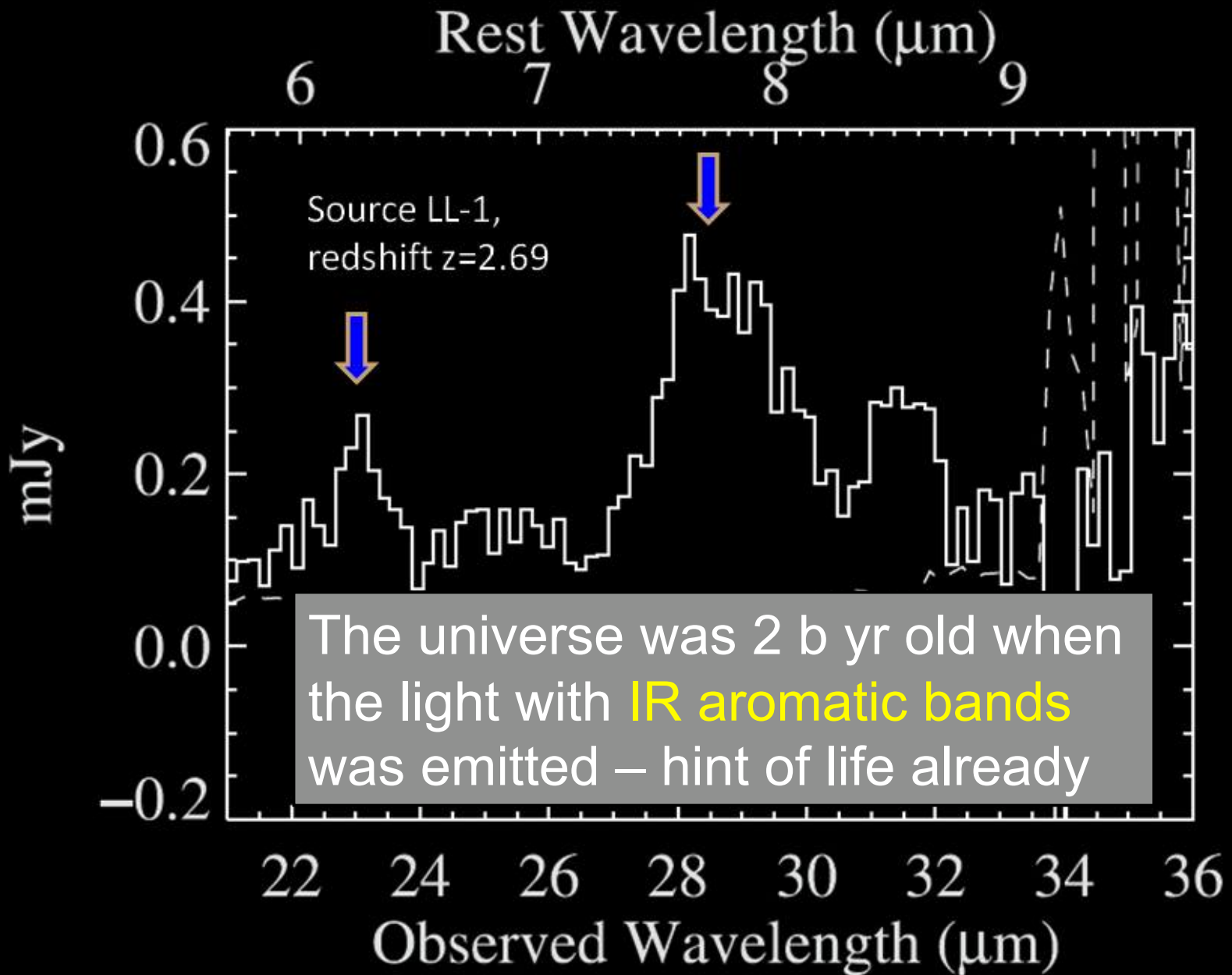


....insuperable probabilities drive us away from the Earth to ever larger cosmological settings...



In March 2014 the oldest galaxies were discovered using IR observations – and found to be chemically similar to modern galaxies

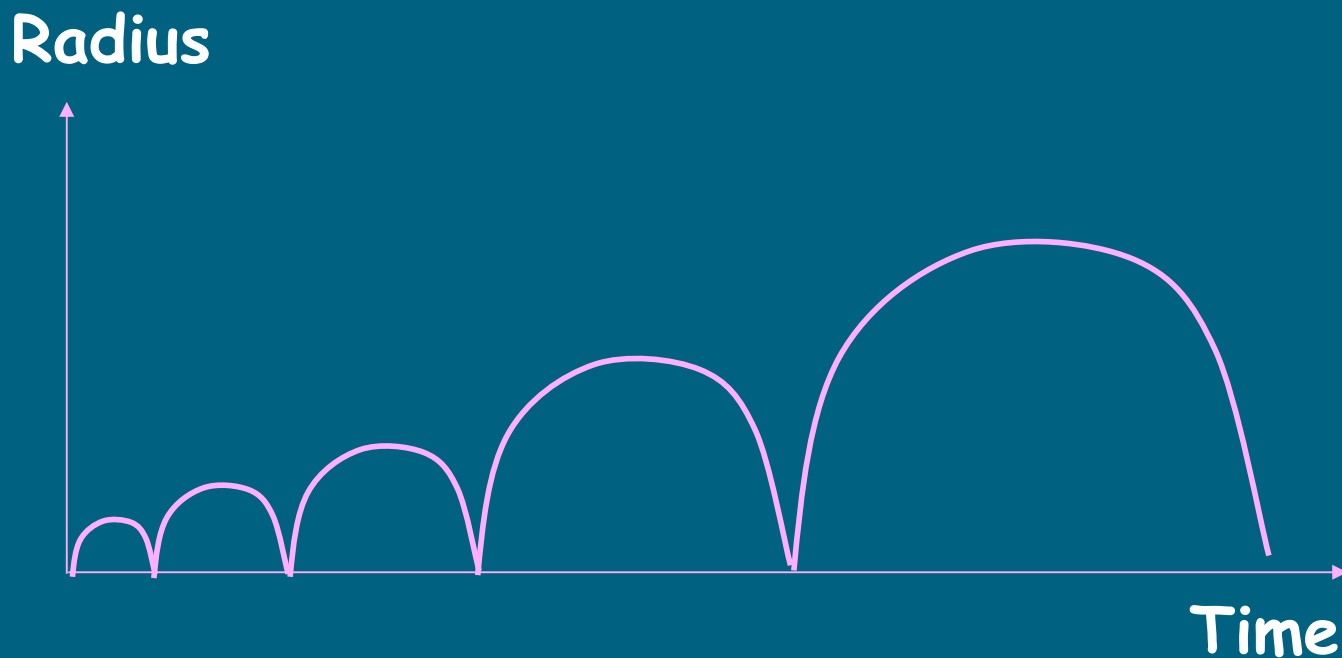




With the universe much more compact at an earlier epoch, an origin of life is much more probable then....certainly within the framework of the Λ CDM standard Big Bang cosmologies



Standard Big-Bang Cosmology is of course not sacrosanct – other models may emerge which have an open timescale

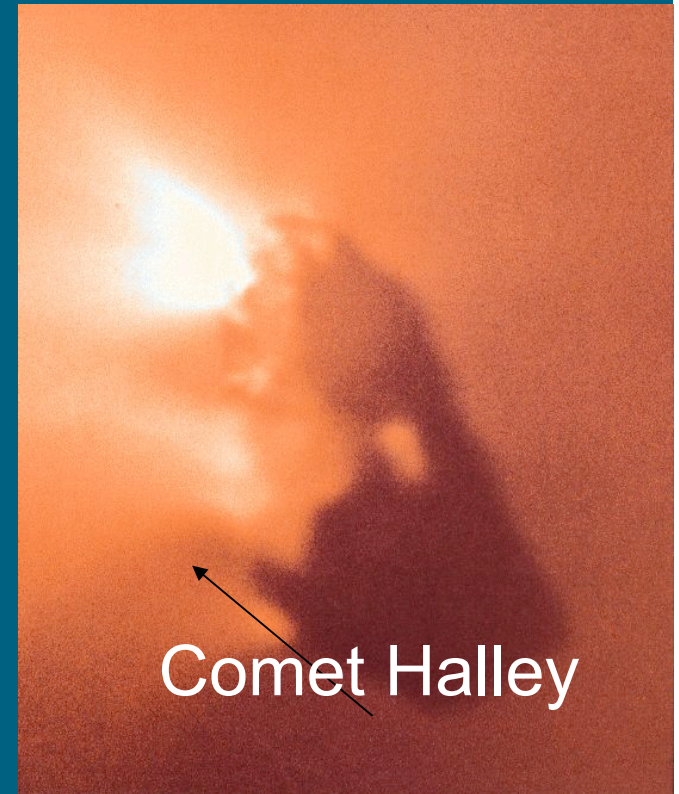
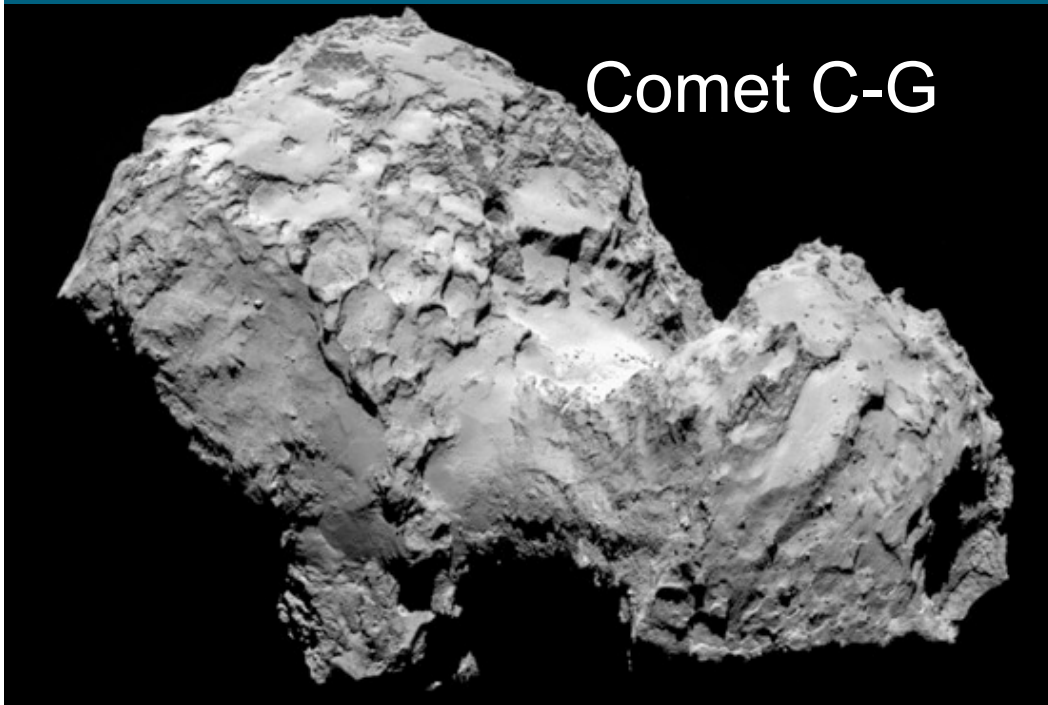


Cyclic, or Quasi-Steady State

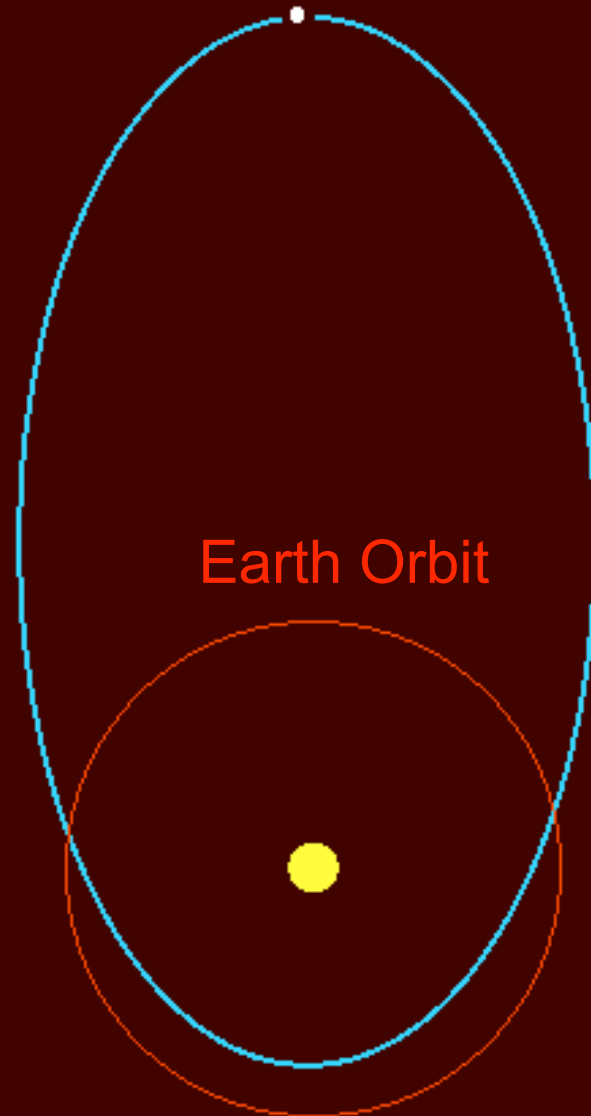


In any case, whichever cosmology one chooses, life **needs only to arise once** in the entire history of the Universe, *panspermia* and comets providing the mechanism by which it spreads, and by which life arrived on Earth

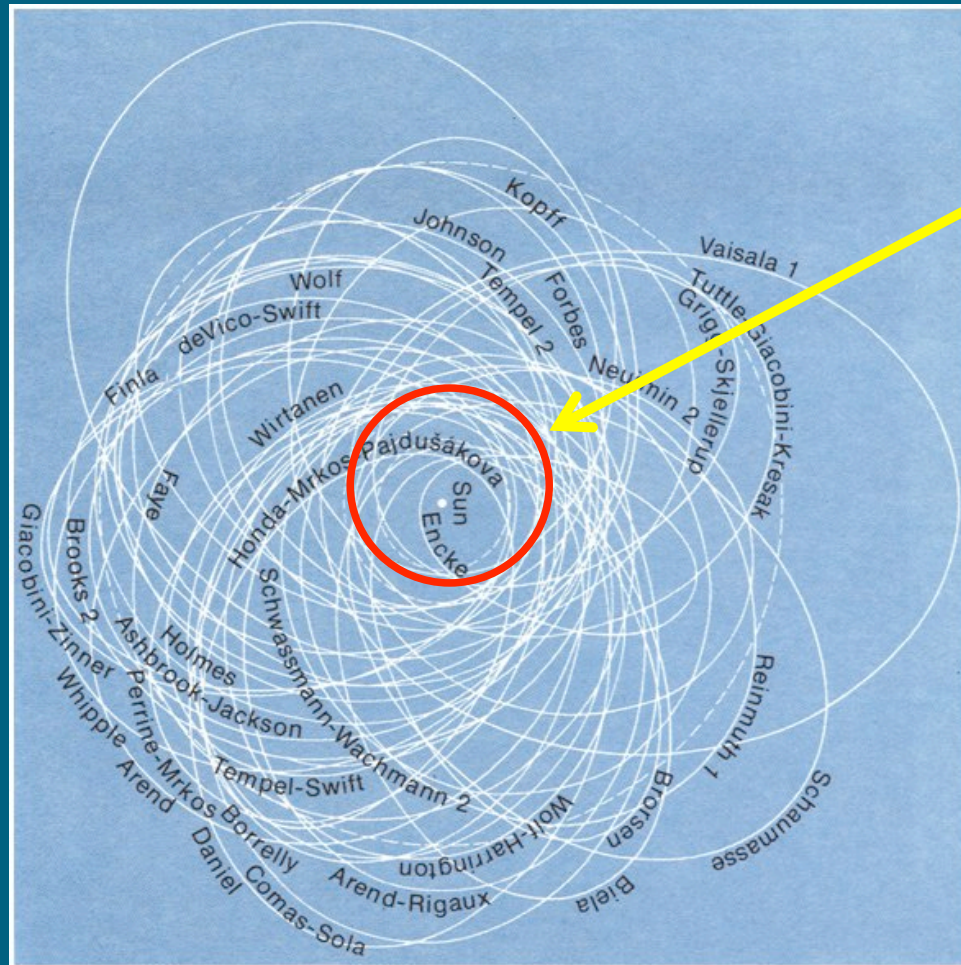
From the 1986 Giotto mission to Comet Halley up to the Rosetta Mission today, comets have been intensively studied and confirmed to be chemically life-like in composition



When a comet comes close enough to the sun, surface layers containing organics and biological material are progressively peeled away into the comet's dust tail



Earth's orbit is in fact enmeshed in debris of comets – that sometimes include pieces of extinct comets



Earth's orbit

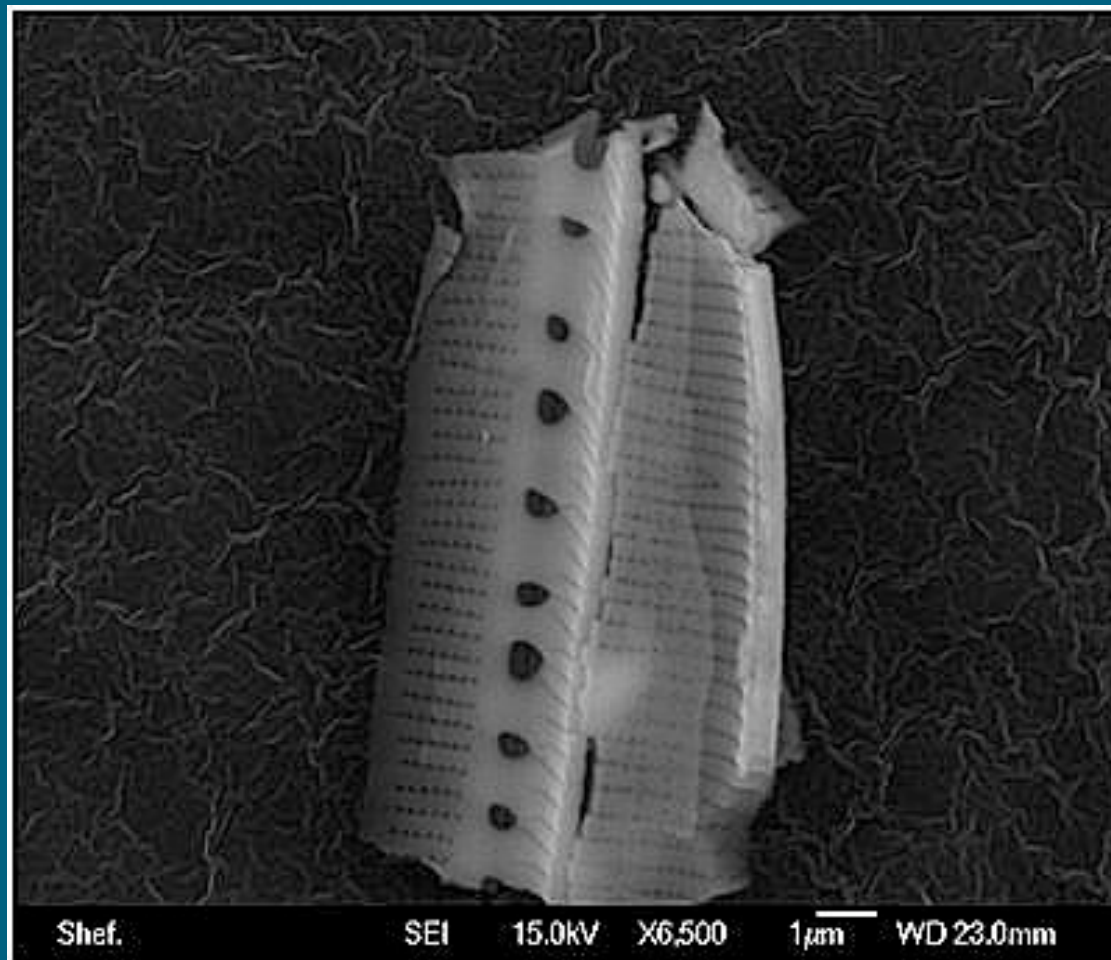
About 100 tonnes of cometary debris falls through the stratosphere daily – most, but not all of it burns up as meteors



•One test to look for microorganisms that reach the stratosphere from above was discussed by Narlikar

In July 2013 Milton Wainwright carried out the latest in a series of similar tests using balloons to collect meteoroids that fell through the stratosphere to a height of 27km – and discovered different types of infalling biological entities

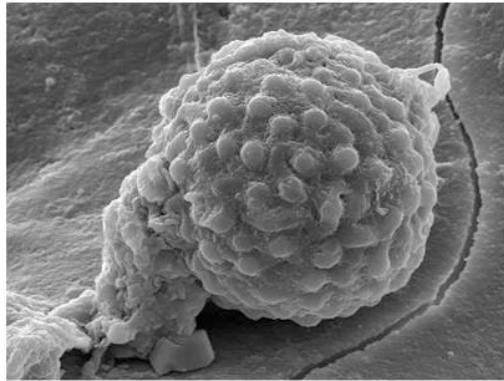
.....Including a fragment of a diatom frustule,
perhaps ruptured on impact



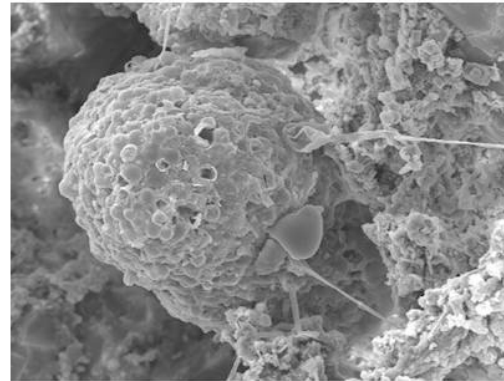


6 months earlier fossil diatoms were found in meteorites that fell in Sri Lanka

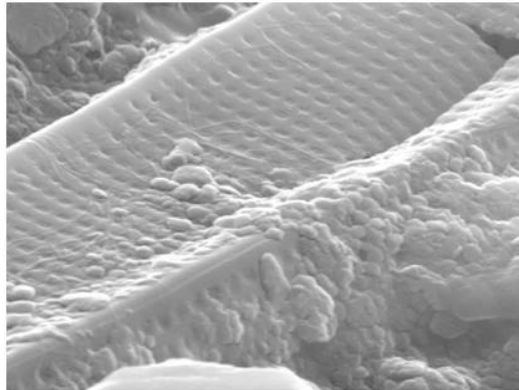
Acritarchs



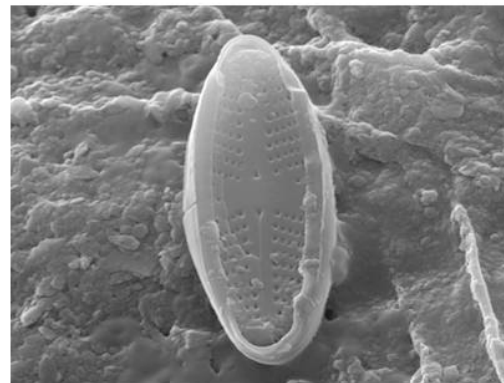
30 μ m



100 μ m



2 μ m



6 μ m

Diatoms

All these structures *cannot* be dismissed as either artefacts or contaminants, as meteorite microfossils have tended to be dismissed in the past

A FEW TECHNICAL POINTS.....

- The ratios of stable oxygen isotopes ^{16}O , ^{17}O , ^{18}O were determined, and found to be *inconsistent* with a terrestrial origin.
- Analysis of trace elements in the bulk composition of the meteorite has yielded high abundances of the element iridium. at levels of 7-8 parts per million
- Such iridium levels found in sediments at the K/T boundary have been used to argue for a comet impact

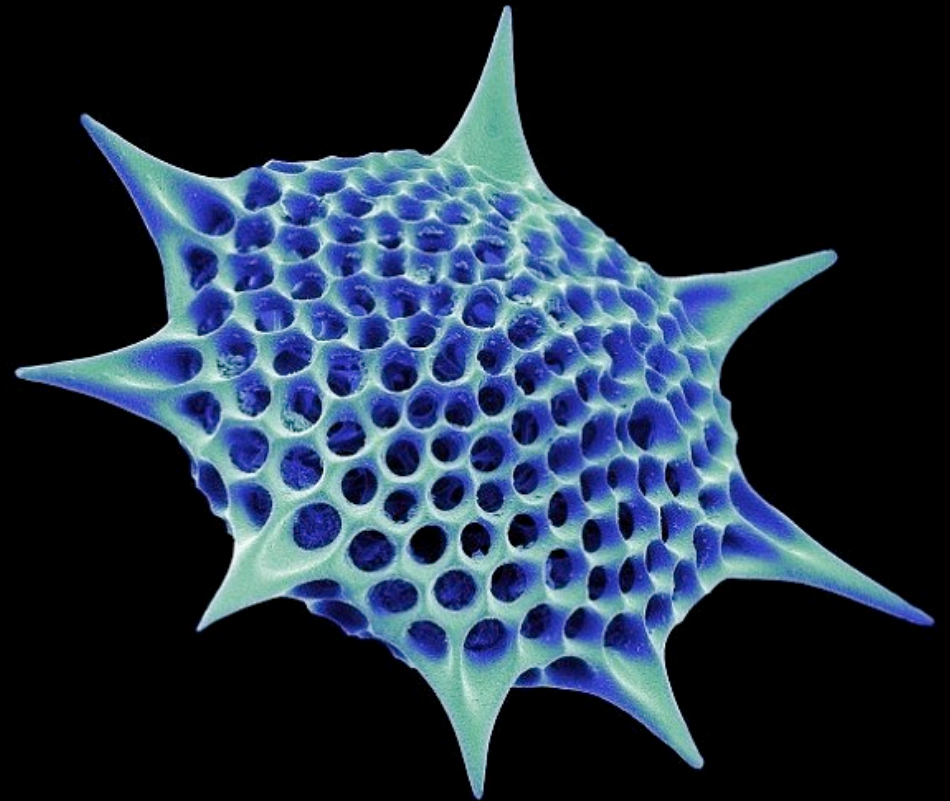
Even more compelling evidence of ongoing entry of lifeforms from space is the recent announcement of diatoms on the surface of the ISS at 400km



August 2014: Marine diatoms found during routine cleaning operation



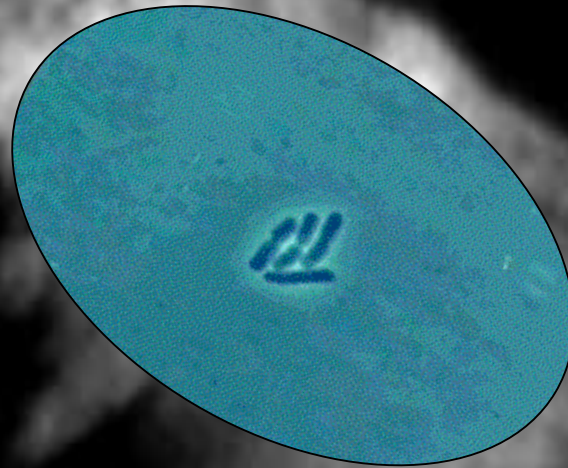
Vladimir Alekseyevich Solovyov (middle)



400 km too high for lofting diatoms from Earth - no air currents can drag surface structures of this size above 20 km – constituting clear proof of panspermia



A fragment of a cometary body, that had once contained a sub-surface lake replete with diatoms, struck the spacecraft at slow relative velocity and stuck to the surface – similarity to terrestrial life forms arises because all diatoms – all life came from space



So far we have discussed bacteria and diatoms as cellular invaders of our planet

New data from gene sequencing studies are beginning to show that viruses are overwhelmingly more important in the scheme of things



The evolution of higher forms of life and the emergence of intelligence depends crucially on this input

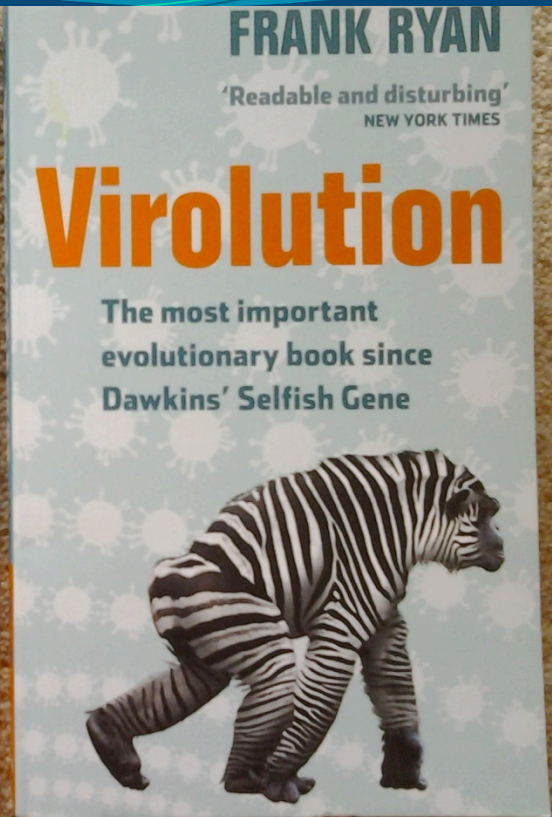
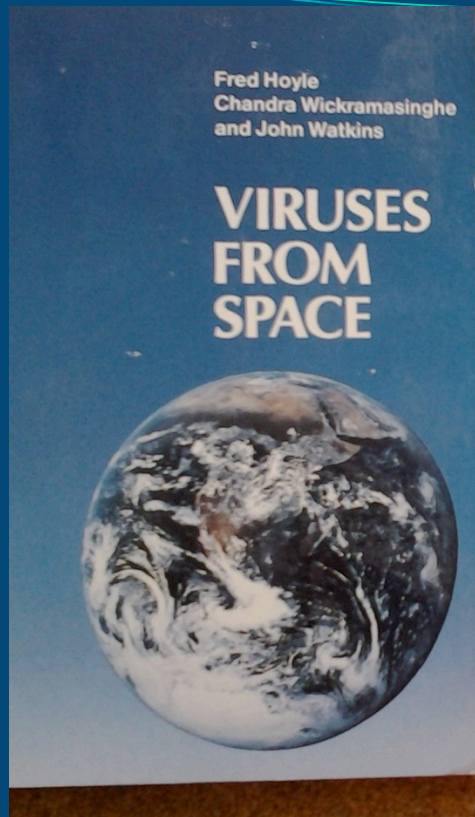
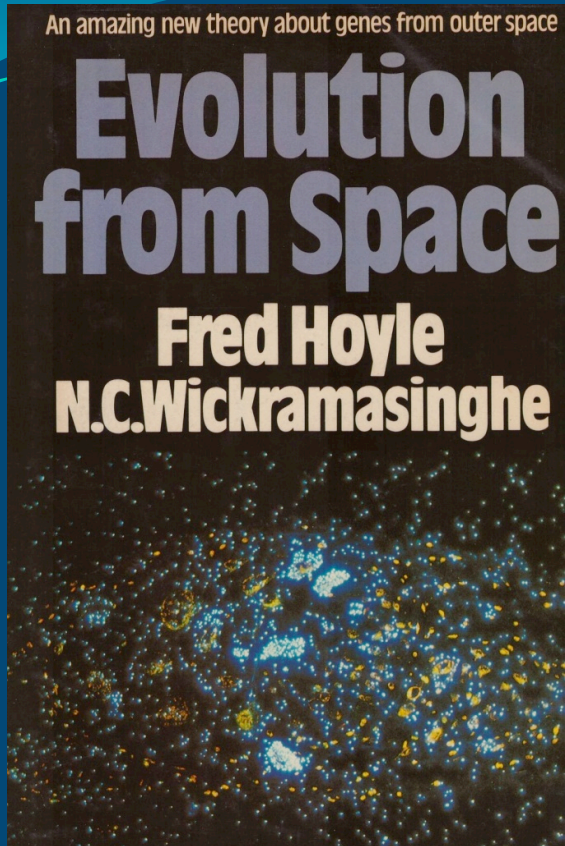
Cosmic cloud of viruses contain genetic programmes for all life



All life on Earth evolves in symbiosis with cosmic viruses



Any species (life-form) that developed total (immunity) exclusion of viruses will cease to evolve and be threatened with extinction

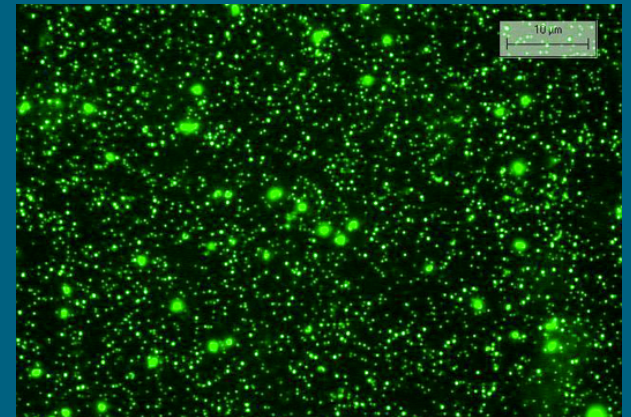


The human genome has been found to contain over 10% of sequences derived from viruses that interacted epigenetically or genetically and directed evolution including brain function (Louis Villarreal)

10 million viruses have recently been counted in a single drop of sea water, and there are an estimated 10^{31} DNA viruses on Earth

Since these viruses degrade on a short timescale, they must be falling into the oceans in the rain

It will be one of ISPA's remits to isolate such viruses in the stratosphere, before they descend to ground level



Important, not just for predicting pandemics and preparing vaccines, but for understanding evolution

The best way to detect pathogenic viruses from comets is by their effect on plants and animals

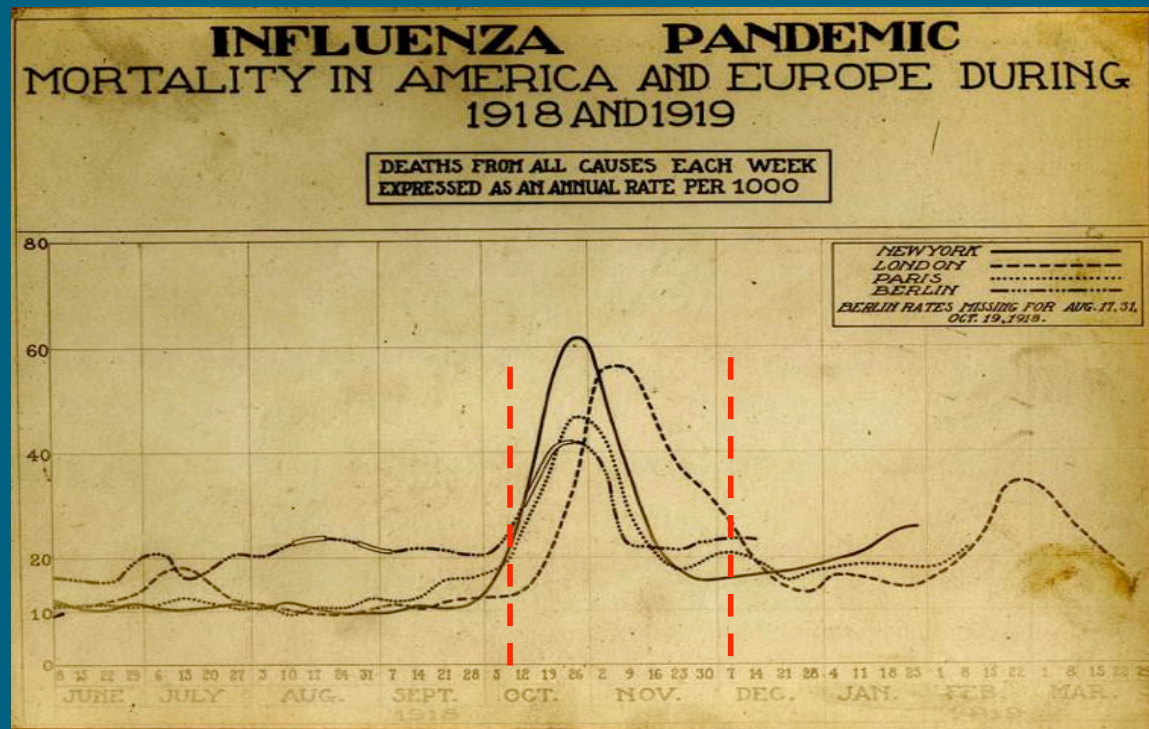
Pathogenic microbe injected
from comets falls to ground

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graph TD; A[Pathogenic microbe injected from comets falls to ground] --> B[No stable Reservoir: Epidemics driven from outside (Eg. Influenza)]; A --> C[Forms reservoir: Creature to Creature Transmission (Eg. Ebola)];
```

No stable Reservoir:
Epidemics driven from
outside
(Eg. Influenza)

Forms reservoir:
Creature to Creature
Transmission
(Eg. Ebola)

Strongest evidence for an ongoing incidence of a viral pathogen from space may be for the case of influenza



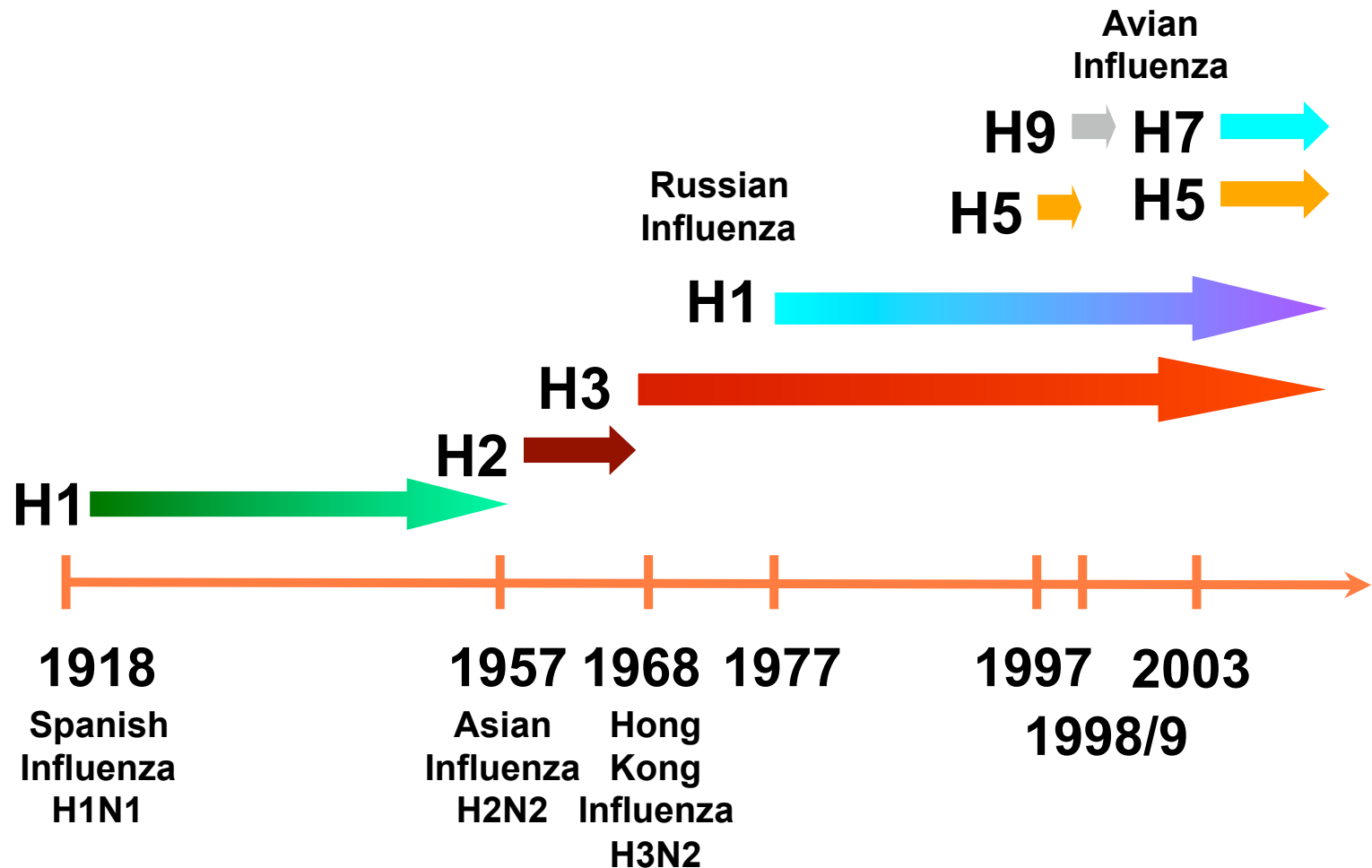
The influenza pandemic of 1918-1919 caused 30 million deaths worldwide

Summarising all the available information Dr. Louis Weinstein wrote thus

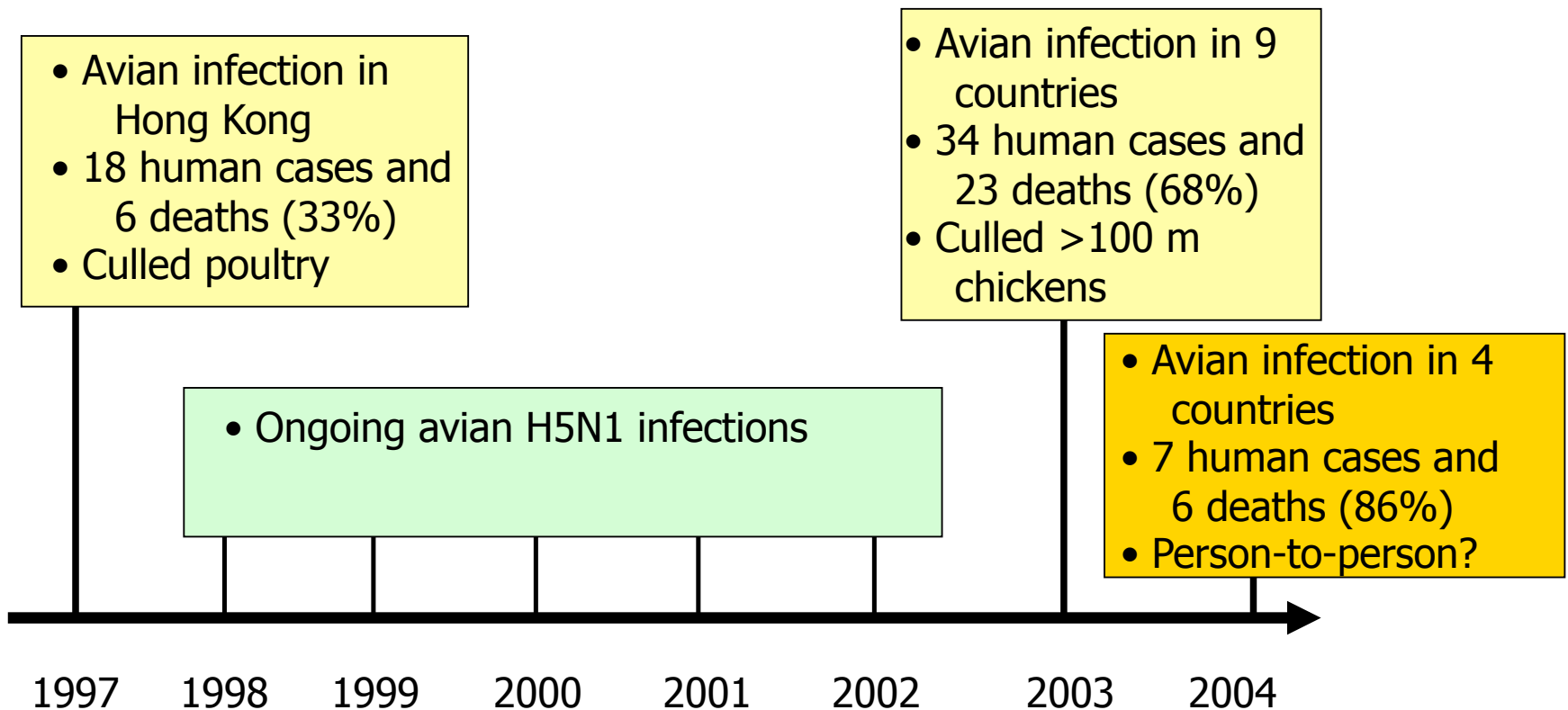
“Although person-to-person spread occurred in local areas, the disease appeared on the same day in widely separated parts of the world on the one hand, but on the other, took days to weeks to spread relatively short distances. It was detected in Boston and Bombay on the same day, but took three weeks before it reached New York City.....”



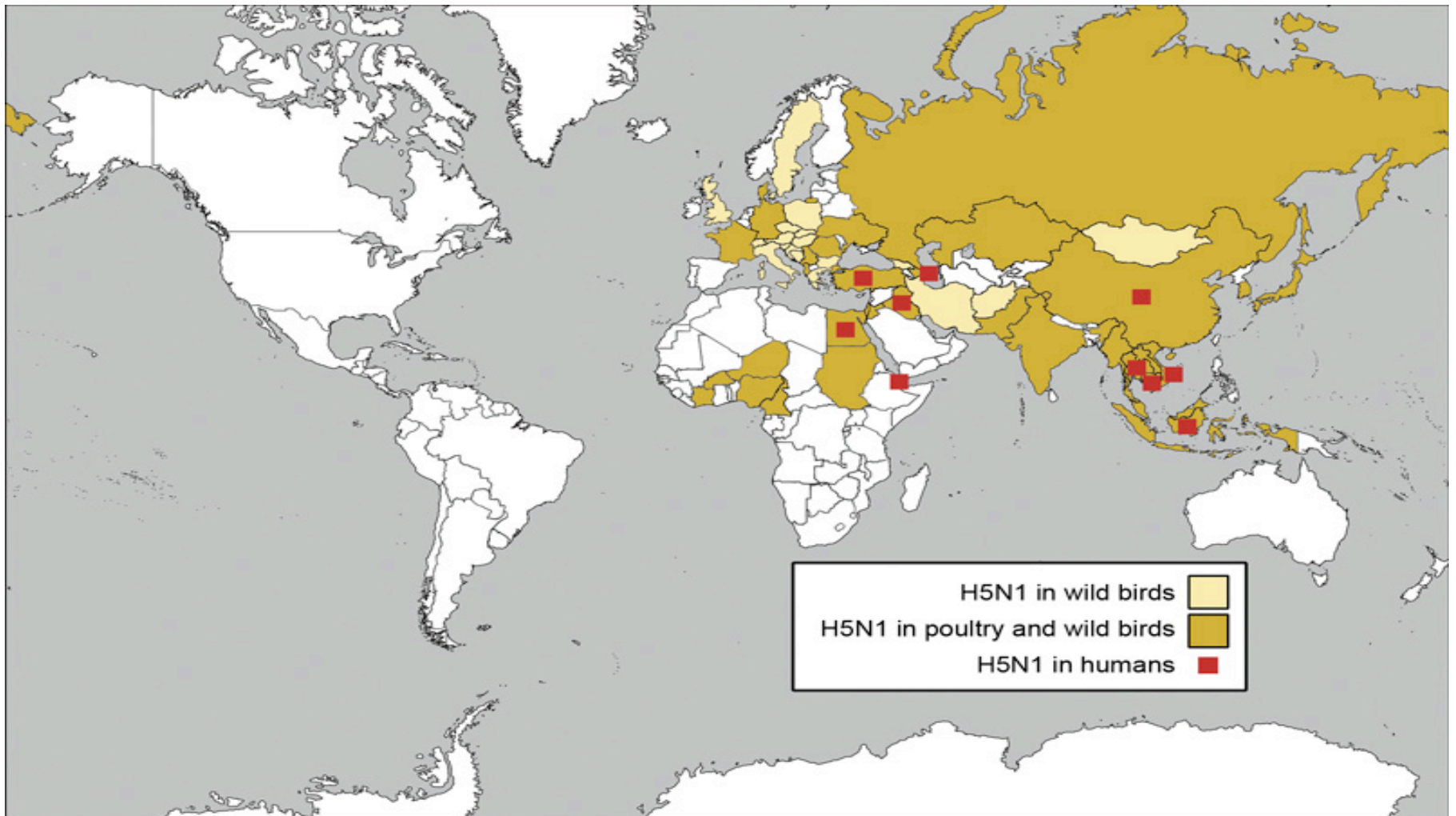
Although recombinations of human and animal influenza viruses have been diligently charted, a pandemic spread has been impossible to predict



Bird Flu (H5N1) was first detected in 1997; its pandemic spread among humans was feared but did not materialise



By May 2006 it was widespread in **birds**, but sporadic, non-transmissible in **humans**



From experience of pandemic flu a component of virus or trigger must fall through the atmosphere and descend to ground level.

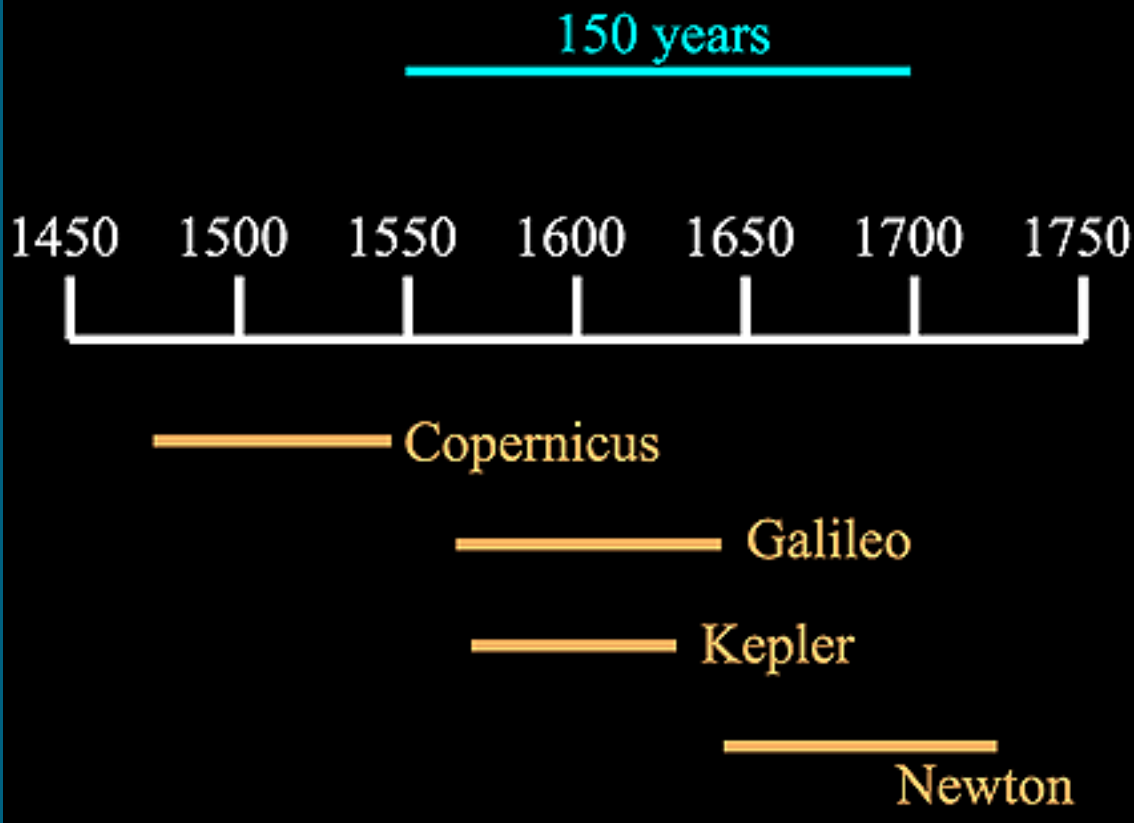
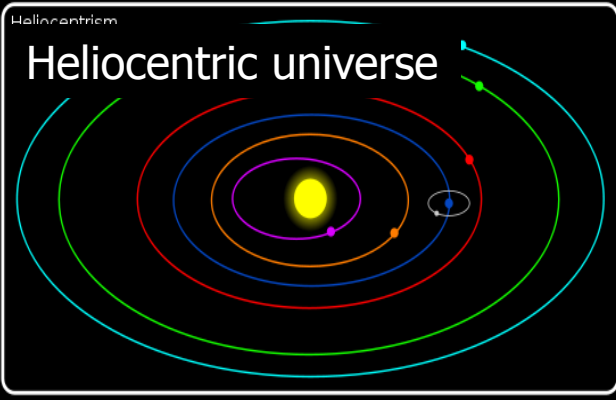
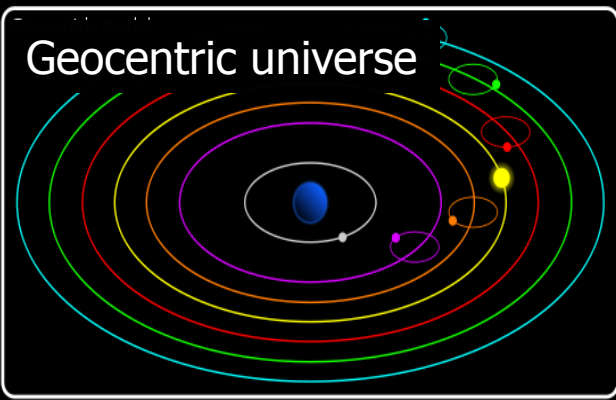


- Finally, I would like to address the issue of social resistance to the ideas I have discussed
- Why, despite overwhelming evidence as we have seen, is the conclusion of cosmic life being resisted in some circles ?

Answer: Culture, religion, innate scientific conservatism

- The long overdue paradigm shift from Earth-centred to cosmic-centred life is an extension of the Copernican revolution which started nearly half a millennium ago

Earth
Moon
Mercury
Venus
Mars
Jupiter
Saturn



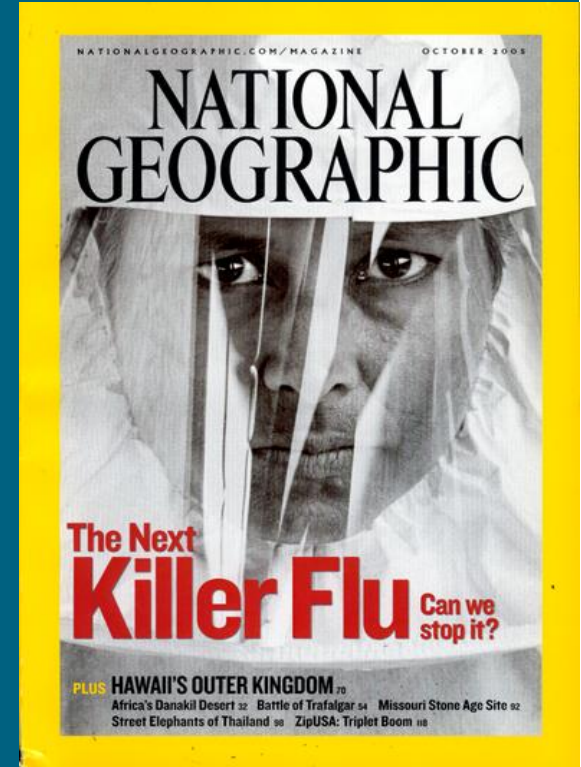
The original Copernican revolution lasted 150 years

Today, an extension of this same revolution may be stalled for **apparently rational reasons** :

- The admission of extraterrestrial life might be perceived as a threat to national security. People may become so scared and emotionally so unsettled that even the enforcement of law and order might pose a problem.
- To admit that we have supported a wrong paradigm may also have economic repercussions in regard to the large funding commitments already in place for exploring ideas based on a totally false premise.

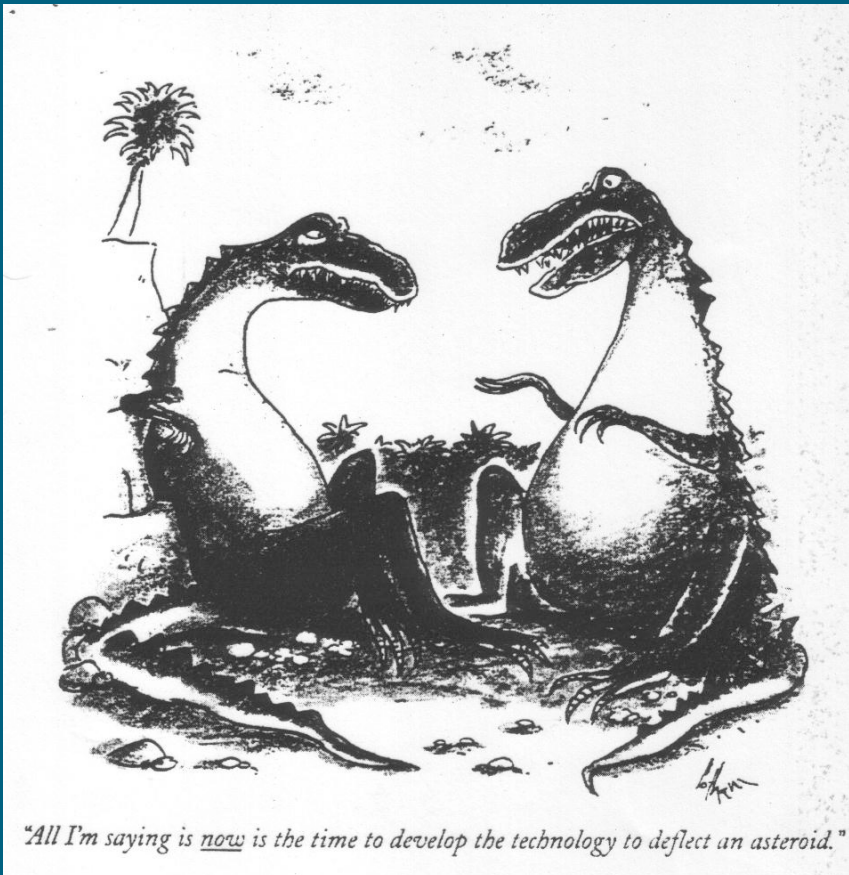
The recognition that alien viruses are raining down on us and are an ever-present threat may necessitate expensive surveillance programmes to monitor the stratosphere

But the cost of ignoring these facts and doing nothing would be even more disastrous



What do we do if we have warning of a lethal virus several months ahead of its fall to ground”

Manufacture of appropriate vaccines could reduce the impact by perhaps a factor of 100

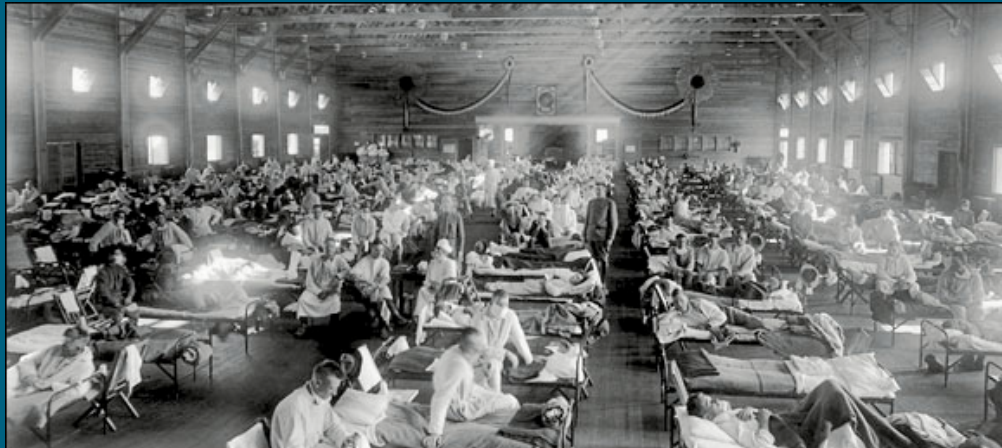


All I'm saying is *now* the time to develop the technology to deflect an asteroid (virus)?

When an H5N1 pandemic was thought imminent
(Newsweek report October 25, 2005)

- 7.4 million lives lost worldwide
- UK's GDP decline by £95 billion (8%)
- Nearly a billion jobs lost as companies go bankrupt

For a full-scale H1N1 type pandemic, losses up 300%



- Perhaps the worst casualty of all will be our self-image as the supreme lifeform in the cosmos, which will be shattered and require major efforts in psychological and educational readjustment.



- It is likely that the entire structure of human society will undergo a transformation more fundamental and profound than any that has taken place so far.

Over tens of thousands of years the smallest unit to which loyalty is owed has expanded

- from the nuclear family
- to the extended family



- the small tribe, as in Neolithic Skara Brae



- the city state



- the nation state



- to all of humanity and to some extent to all life that shares our biosphere





- The next transition must be to a full recognition that we are all part of a vast cosmic living system
- A new cosmic consciousness would surely dawn