

## GROWING EVIDENCE FOR COSMIC BIOLOGY

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### Abstract

New data from astronomy and biology continues to favour the Hoyle-Wickramasinghe theory of cometary panspermia. Alternative explanations on the basis of Earth-centred biology, with Neo-Darwinian evolution occurring within a closed system, appear to be far-fetched and fundamentally flawed.

**Keywords:** Astrobiology, panspermia, interstellar matter, viruses

The discovery of the intricately complex structure of enzymes, the work-horse molecules of all life<sup>1</sup>, came close upon the heels of unravelling the structure of DNA<sup>2</sup>. The new millennium began with the successful completion of sequencing the entire human genome, which followed the earlier sequencing of genomes of “lesser” life-forms<sup>3</sup>. The overarching message to emerge from over half a century of work in molecular biology was the mind-boggling complexity of living forms at a molecular level. The odds against the assembly of the essential macromolecules from their components by random processes to result in the simplest living cell are measured in super-astronomical numbers, and this fact alone should have informed scientists that the canonical model of an origin of life in a warm little pond on Earth should be abandoned<sup>4</sup>. Likewise the problem of the origin of life cannot be dismissed by simply asserting that a “cosmic imperative” determines that life arises anywhere and everywhere in an inorganic universe<sup>5</sup>.

Geological evidence now points to the Earth being seeded with life some 4 billion years ago, and this occurred during an epoch of intense collisions with comets – the Hadean Epoch<sup>6</sup>. The obvious inference to be drawn from all the available facts is that life must be a cosmic phenomenon and was delivered to Earth by comets<sup>7,8</sup>. A weakened version of the same idea that is rapidly gaining ground is that comets seeded the Earth with only the chemical building blocks of life, and that the improbable assembly of these into a living system happened on the our planet. This still leaves unanswered the question of how the superastronomical improbability gap between non-life and life was bridged in what appears now to be a vanishingly interval of geological time<sup>9</sup>. The rational inference that can be drawn from all the available facts is that life is a truly cosmic phenomenon<sup>10</sup>. Its origin with the fullest range of genetic possibilities was a unique cosmological event that must have occurred *somehow* against incredible odds. The precise timing of this event cannot be determined but it is likely to be within the first million years of its existence<sup>11</sup> within the framework of appropriate Big-Bang cosmologies. The subsequent spread of life occurs by means of the process of cometary panspermia<sup>7,8</sup>.

The patterns of biological evolution on the Earth appear to reflect an ongoing interaction between viruses (that make up the bulk of the mass of the biosphere) and emerging species over a period of 4 billion years. The best studied time interval in this in the operation of this process involves the past few million years that traces the evolution of *Homo sapiens*.

During this time interval, studies of the disposition of human as well as primate genomes have revealed a complex interplay between viruses and host organisms<sup>12,13,14</sup>. The emerging picture is of viruses supplying essentially all the information needed for the evolution of humans, and indeed of all life on Earth and elsewhere. Neo-Darwinian processes involving sequential mutations and natural selection act only as a kind of fine-tuning.

These ideas have gained support from recent discoveries indicating that viruses dominate the biomass of the Earth by a large factor. A single drop of ocean water has been found to contain no less than  $10^7$  viroids and the total number of viruses on the Earth is at least  $10^{31}$ . If all the viruses on the Earth are lined up, the total length of the viral genome will stretch a distance exceeding a megaparsec (Mpc) (1Mpc is a typical distance between galaxies). Even more impressive, perhaps, is their total dispersible high grade genetic information content which adds up to a formidable  $10^{23}$  TB (terabytes). In view of the well-attested role of viruses in gene transport across species, it would be foolish to ignore the impact of viruses on the evolution of life on a cosmic scale. Neo-Darwinian processes that involve mutations followed by natural selection must be relegated to the role of a relatively minor, but nevertheless important, fine tuning process in the evolution of life. The genes needed for novel developments of life, according to our point of view, are derived in the form of viruses *gratis* from the cosmos – a far richer and more varied environment than anything that can be imagined on the Earth.

Direct evidence for the operation of this process, including the recovery of cometary microorganisms, has been discussed elsewhere<sup>15,16,17</sup>. Astronomical data supporting these ideas have accumulated from the early 1980's; and significantly no data from either astronomy or biology has turned up to seriously challenge the life-from-space thesis<sup>18,19</sup>. The close fits of astronomical data sets to biological models have included the 2175A interstellar absorption feature, the diffuse infrared bands as well as the diffuse optical bands and the extended red emission (ERE) – a fluorescent effect of organics – observed in many galactic and extragalactic sources.

The astronomical facts that are most cited nowadays in favour of the hypothesis of prebiology are concerned with the ever-increasing numbers of specific organic molecules discovered by radio-astronomical techniques. Here the strong selection bias is to discover relatively small and mostly asymmetric molecules (with non-zero dipole moments) which have measurable transitions in the radio and millimetre wavebands. The recent discovery of an interstellar molecule, isopropyl cyanide,  $C_3H_7CN$  with a branched carbon structure has been much publicized and hailed as evidence for the beginnings of life interstellar space. Whilst the researchers should be congratulated for the detection of a new class of interstellar organic molecule, arguing a case for the emergence of life on this basis is premature. The presence of branched structures is a common feature of molecules such as amino acids, which are the building blocks of proteins; but they are also present in the metabolites of biology and in their degradation products. It is of interest that the group of organic cyanides (R-CN) are produced in many organisms including algae, fungi and plants, and in some cases produced as defensive metabolites<sup>20,21</sup>.

Although the fits of a wide range of astronomical data with the single overarching hypothesis of cosmic biology continues to be impressive, they have been largely ignored in favour of a class of non-biological models involving a large number of arbitrary parameters and the *ad hoc* assumption that pre-biotic evolution must be happening everywhere. There is clearly no logic for this, nor are there any facts to support it. In any case, as Julius Caesar said,

“*fere libente homines id quod volunt credunt* – men readily believe what they want to believe...”... From Caesar: *The Gallic Wars, III*

and they would continue to do so until they sense the danger of holding to their wrong beliefs.

Such dangers may lurk around the corner<sup>17</sup>!

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