

**'The Relation of Biology to Astronomy' and Theology:
Panspermia and Panentheism;
Revolutionary Convergences Advanced by Fred Hoyle and Chandra Wickramasinghe**

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Abstract

In contrast to the Copernican revolution in astro-geometry, the Hoyle-Wickramasinghe contribution to the recent and continuing revolution in astrobiology—"cometary panspermia"—features astronomy and biology converging toward theology. They employed astro-biotic reasoning (often labeled "anthropic" reasoning) to demonstrate that life is made possible by the deliberate controlling influence of the living all-embracing "intelligent universe." This is consistent with panentheism [pan-*en*-theos-ism, not pantheism]. As advanced by Hoyle and Wickramasinghe, cometary panspermia is panentheistic. Also, neoclassical panentheism requires generic panspermia, and favors cometary panspermia.

Key words: astronomy, biology, astrobiology, theology, astro-theology; panspermia, panentheism.

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I. Connecting Astronomy to Biology

1. Interstellar Bacteria

Sir Fred Hoyle in his 25-page book *The Relation of Biology to Astronomy* (1980) connected observational astronomy to biology (study of life and conditions admitting the possibility of life). He started with the observed “fogging of starlight”—technically called “extinction of starlight”—caused by starlight passing through clouds of “tiny solid particles” called “interstellar grains” (1980, p. 3), and he presented evidence favoring his hypothesis that “*Interstellar grains are bacteria*” (1980, p. 13).

The evidence is this: Hoyle noted that the observed extinction of starlight can be plotted on a curve [Figure 1 featured a “General extinction curve” with an extinction peak at a wavelength of about 2200Å that had been predicted by N. Chandra Wickramasinghe and Hoyle (1980, p. 3).]; and that when bacteria are theoretically placed on this extinction curve [“using the size distribution of bacteria given by laboratory data” (1980, p. 18)], according to Wickramasinghe’s calculations, the theoretical extinction curve closely matches the observed extinction curve. The observed extinction curve is consistent with starlight being fogged by bacteria. And, unlike nonbacterial theories, the bacterial theory of starlight extinction includes no adjustable parameters. Hence, uniquely “excellent results” derive from hypothesizing that clouds of interstellar gas and dust include huge quantities of “biotic material” (1980, p. 18-19).

According to Hoyle, biotic materials are continually circulated and recycled—via stars, planets, and comets—in ways that produce “amplified biotic material” within an “amplifying cosmic life-cycle” (1980, p. 19). Hoyle said:

If the grains are bacteria, and I have presented evidence which almost demands that the grains really are bacteria, then life is not confined to a particular galaxy, or to a few galaxies. Life can spread itself through the Universe.
(Hoyle, 1980, p. 23)

And though theories of interstellar biotic materials were widely rejected; Hoyle concluded *the Relation of Biology to Astronomy* by predicting that “the cosmic quality of microbiology will seem as obvious to future generations as the Sun being the centre of our solar system seems

obvious to the present generation” (1980, p. 25).

Additional arguments favoring cosmic microbiology are in *Proofs That Life is Cosmic* (1982) by Hoyle and Wickramasinghe, and in “The Case for Life as a Cosmic Phenomenon” (1986) in *Nature* where Hoyle and Wickramasinghe say the following:

The arguments in support of life as a cosmic phenomenon are not readily accepted by a culture in which a geocentric theory of biology is seen as the norm. ... Still pursuing the infrared problem we eventually found that among organic materials polysaccharides gave the best correspondence to the astronomical data ..., and it was exactly at this point in our work that we began to experience hostility from the referees of journals and from the assessors of grant applications at what was then the Science Research Council. We realize now that because polysaccharides on the Earth are a biological product we had unwittingly made a contact that is *deeply forbidden* in our scientific culture, *a contact between biology and astronomy*. ...
(Hoyle and Wickramasinghe, 1986, p. 509 [italics added])

By arguing for interstellar microbiological processes, Hoyle and Wickramasinghe were making “deeply forbidden” connections between biology and astronomy. And, they were developing the convergent science of “astrobiology” (Sun Kwok 2011, Wickramasinghe 2011a).

2. Cometary Panspermia

Such “deeply forbidden” connections were made in their essay “Comets – a Vehicle for Panspermia” (reprinted in JOC, 2011, Vol. 16) from the book *Comets and the Origin of Life* (1981a). Here, Hoyle and Wickramasinghe argued that life is cosmic, that “comets carry, amplify and disperse life throughout the universe” (2011 [1981a], p. 6537), and that life on the primordial Earth originated from previous life (and water) carried to Earth by comets and “the deposition of cometary particles at the top of the atmosphere” (Ibid, p. 6545). Wickramasinghe describes this essay as the first “explicit exposition of our cometary panspermia theory” (Ibid, p. 6537). [Also, see chapter 11—“Comets: visitors from distant space”—in Hoyle and Wickramasinghe’s *Lifecloud: The Origin of Life in the Universe* (1978).] Since then, the probable truth of “cometary panspermia” has become more obvious in light of recent discoveries from studying comets and meteorites.

Recent evidence from comet studies supports the idea that water and other ingredients (building blocks) essential to life were brought to Earth by comets. For instance, NASA’s Comet Sample Return Mission—Stardust—(07 Feb 1999 launch, 02 Jan 2004 sample collection, 15 Jan 2006 sample return) lead to the discovery of the amino acid glycine in particles from comet Wild 2. This discovery suggested “comets must have delivered at least one amino acid to our planet before it had life” (Don Brownlee, Stardust Principal Investigator, 2009, “Stardust: A Mission with Many Scientific Surprises”). [Philip Grose calls attention to the Stardust Mission in “A Theological Response to the Possible Discovery of Extraterrestrial Life” (2011). Here, quoting

from “NASA Researchers Make First Discovery of Life’s Building Block in Comet” (2009) by Bill Steigerwald, he says: “Dr. Carl Pilcher, who leads NASA’s Astrobiology Institute commented that ‘The discovery of glycine in a comet supports the idea that the fundamental building blocks of life are prevalent in space, and strengthens the argument that life in the Universe may be common rather than rare’” (Grose, 2011, p. 4).] Also concerning the discovery of glycine in comet Wild 2, Jamie Elsila of the NASA Goddard Space Flight Center is quoted as saying: ““Our discovery supports the theory that some of life’s ingredients formed in space and were delivered to Earth long ago by meteorite and comet impacts’” (Steigerwald, 2009).

More evidence from the study of comets is forthcoming. For instance, the ESA Rosetta spacecraft (launched on 02 March 2004) is scheduled to catch comet 67P/Churyumov-Gerasimenko in May 2014, and to deploy a robot to harpoon, anchor to, soft-land on, and study that comet in November 2014 (Project Manager and Project Scientist, Claudia Alexander, 2010).

And we can expect more evidence from the study of meteorites derived from comets. Already, evidence has come from finding what appear to be fossils of extraterrestrial cyanobacteria in the interior of carbonaceous meteorites. See “Fossils of Cyanobacteria in CII Carbonaceous Meteorites: Implications for Life on Comets, Europa, and Enceladus” (2010) by Richard B. Hoover. [Also, see the Hoyle-Wickramasinghe discussion of “fossil-like structures” in Type I carbonaceous chondrites, “most probably ‘spent’ comets” (p. 111), in chapter 12—“Meteorite clues”—in *Lifecloud* (1978).]

Plus, new evidence, perhaps living microbes instead of only fossils, will come from studying newly collected materials provided by returning spacecraft and high altitude balloons. For instance, the Indian Space Research Organisation (ISRO) is planning “aseptic collections of stratospheric air above the tropopause” (Wickramasinghe et al., 2011c, p. 6568). And, other missions to collect and return more distant materials are being planned. Finding living microbes among uncontaminated extraterrestrial materials will provide decisive proof that microbial life is not confined to planet Earth.

II. Connecting Astrobiology to Theology

3. Scientific Revolutions and Theology

Given mounting evidence of widespread interstellar microbiological processes; it is becoming increasingly obvious that Hoyle was correct, that life did not originate on planet Earth (1980, p. 21; also p. 24). Nevertheless, Hoyle recognized that many people still preferred to believe that “life started on the Earth by an incredible fluke, with a chance so tiny that life could not have happened anywhere else at all” (1980, p. 21). His judgment was this:

... even to this day many people have learned little from the old Copernican controversy. By preference, they are still pre-Copernican. Robbed of the Earth as the geometrical centre of the Universe, they are avid to make the Earth the biological centre of the Universe.

(Hoyle, 1980, pp. 21-22)

This is “revolution-making” science (Thomas S. Kuhn, 1957; N. M. Swerdlow, 2004). As the “Copernican Revolution” (Kuhn, 1957) initiated by Nicolaus Copernicus’s *De revolutionibus orbium coelestium* (1543) came from recognizing that Earth is not the geometrical center of the universe; another “scientific revolution” (Kuhn, 1962) is coming from recognizing that Earth is not the biological center of the universe.

The Copernican Revolution was a problem for theology. According to N. M. Swerdlow:

Copernicanism still poses problems to theology. Indeed, one may wonder whether theology has ever taken in the significance of the removal of the earth from the center of the universe, let alone all that has followed from it.” (Swerdlow, 2004, p. 101)

Unlike the Copernican revolution in astro-geometry, and unlike the Darwinian achievements in biology that “completed the Copernican revolution” (Francisco J. Ayala, 2008, p. 68); the Hoyle-Wickramasinghe contribution to the present revolution in astrobiology features astronomy and biology converging toward affirmative theology.

4. Astronomy and Biology Converging Toward Theology

In addition to connecting astronomy to biology in *The Relation of Biology to Astronomy* (1980), Hoyle implied an astrobiological affirmation of theology by speculating that astronomical processes are controlled by living intelligence in ways favoring life.

Astronomers have become accustomed to thinking of the external Universe in the words of Macbeth, as being “full of sound and fury, signifying nothing”. Can we seriously believe that anything as subtle as biology could have gained a toehold in a world signifying nothing? I pondered this question for a long time before arriving at a strange answer to it. If the astronomer’s world of fury is really in control, then the prospects for biology would be poor. But what if it is really biology which controls the astronomer’s world?
(Hoyle, 1980, p. 22)

You may wish to follow this line of thought with the question: Is the biological control over astronomy to be an *intelligent control* or is it to be a product of blind evolutionary processes signifying nothing? Because there are no facts one can only speculate. My personal speculation would be that the control is intelligent.
(Hoyle, 1980, p. 23 [italics added])

Insofar as this agrees with the religious idea of a supremely intelligent Creator-Provider-Sustainer of the universe, Hoyle’s idea of biology-friendly “intelligent control” (1980, p. 23)

over astronomical processes is at least implicitly pro-theological.

Implicitly pro-theological astrobiology became explicitly pro-theological in chapter 9—“Convergence to God”—of *Evolution from Space* (1981b) by Hoyle and Wickramasinghe. Given prevailing strongly anti-theological sentiments among scientists, Hoyle and Wickramasinghe were risking their good standings as scientists by progressing from implicit to explicit affirmations of theology. They started chapter 9 by saying: “At this point, if only in the interest of retaining our credentials as scientists, it might be as well to stop” (1981b, p. 129). However, they did not stop.

They continued. They affirmed theology because “a proper scientific outlook” required facing calculations showing that “a random shuffling of amino acids would have as little chance as one part in $10^{40,000}$ of producing the enzymes” (1981b, p. 129). This evidence from biology makes it super—($10^{40,000}$!)—improbable that life originated from random processes.

At this point, if only in the interest of retaining our credentials as scientists, it might be as well to stop. After all, no biologist has cause for complaint with the present situation. ... for a century or more biologists have believed that the Earth provided an environment sufficient for the origin and evolution of life ...

Yet if we are to maintain a proper scientific outlook, the numbers calculated in chapter 2 [entitled “Enzymes and other biochemicals”] have to be faced at some stage. We showed there that a random shuffling of amino acids would have as little chance as one part in $10^{40,000}$ of producing the enzymes. ...
(Hoyle and Wickramasinghe, 1981b, p. 129)

Once we see ... that the probability of life originating at random is so utterly minuscule as to make the random concept absurd, it becomes sensible to think that *the favourable properties of physics on which life depends are in every respect deliberate*.
(Hoyle and Wickramasinghe, 1981b, p. 141 [italics added])

Hoyle and Wickramasinghe argued that plausible answers to questions about the origins of life require recourse to astronomical-cosmological processes that provide conditions making life possible, and recourse to an “exceedingly high” “measure of intelligence” to deliberately control life-providing processes and properties mathematically described by “the coupling constants of physics” (1981b, pp. 141-43). This exceedingly high intelligence includes and exceeds all others. And “like a convergent mathematical sequence of functions,” this exceedingly high measure of intelligence “has an idealized limit,” and “It is this idealized limit that is *God*, and *God* is the universe ...” (Hoyle and Wickramasinghe, 1981b, p. 143 [original italics]), the living divine “intelligent universe” (Hoyle, 1984 [c1983]).

III. Converging Revolutions

5. Censorship

For most of the 20th century, perhaps well into the 1990's, among scientists, connecting astronomy to biology [astrobiology] was “deeply forbidden” (Hoyle and Wickramasinghe, 1986, p. 509); and connecting astronomy to explicit affirmative theology [“astro-theology” (William Derham, 1715)] was more deeply forbidden. Though the scientific prohibition against astrobiology has been repealed [due also to the influence of astrobiologist/exobiologist Carl Sagan], skepticism still prevails; and the scientific prohibition against astro-theology remains strong.

Hoyle and Wickramasinghe challenged both prohibitions when both were strong (Hoyle starting in the 1950's, Wickramasinghe joining him in 1960's). It is no wonder that they experienced “hostility from the referees of journals and from the assessors of grant applications” (Hoyle and Wickramasinghe, 1986, p. 509), plus ridicule, opposition, and censorship (Wickramasinghe, 2011b). Nevertheless, censorship failed. And convergence continued.

As Hoyle predicted, advancing the forbidden convergence of astronomy and biology [yielding astrobiology] made “the cosmic quality of microbiology” (1980, p. 25) more obvious. This was a revolutionary advance. It is now predictable that advancing the more deeply forbidden convergence of astrobiology and theology [yielding “astro-theology” (William Derham, 1715)] will make the theological quality of cosmology and biology more obvious.

6. Panspermia and Panentheism

“Panspermia” labels a revolution in astronomy and biology. Similarly, “panentheism” labels a revolution in theology. [See “Naming a Quiet Revolution: The Panentheistic Turn in Modern Theology” (2004) by Michael W. Brierley.] And convergently, the Hoyle-Wickramasinghe conception of the living intelligent universe (deliberately exercising controlling influence to provide for the possibility of life) resembles panentheism.

Panentheism

The term “panentheism” was constructed from Greek by German Kantian mystic Karl Christian Friedrich Krause (born 1781, died 1832) for describing a distinct theological cosmology expressed in various ancient, classical, and modern contexts. Today, Whitehead-instructed panentheism is often called “process theology.” Panentheism instructed by Whitehead *and* Hartshorne is often called either “process theology” or “neoclassical theology,” and occasionally called “neoclassical panentheism” or, given greater emphasis upon cosmology, “neoclassical cosmology” (Walker, 2010).

According to panentheism (*pan en theos*-ism, not pantheism): All parts of reality [*pan*] are included in [*en*] and “creatively synthesized” (Hartshorne, 1970) by the one all-inclusive eternally-creative whole of reality [the divine Creator, *theos*]. Contrary to pantheism (*pan = theos* -ism), panentheism (*pan en < theos* -ism) holds that *theos* [the divine whole of reality] is greater than, and inclusive of, *pan* [all parts of reality (summarily called “the world” or “the universe”)]. [“World-inclusive” or the “W factor” is considered in Hartshorne's introduction to

Philosophers Speak of God (1953) by Hartshorne and William L. Reese.]

All-Embracing Intelligence Affirmed by Astrobiology

Using astro-biotic reasoning [sometimes inadequately labeled “anthropic” reasoning] about conditions/properties necessary to the possibility of life as such [not just human/anthropic life], including especially microbial life; Hoyle and Wickramasinghe found that life is made possible by the deliberate controlling influence of universal divine intelligence (Hoyle and Wickramasinghe, 1981b), the living “intelligent universe” (Hoyle, c1983), the “all-embracing intelligence” (Hoyle 1984 [c1983], p. 215). This is consistent with panentheist ideas developed by Rāmānuja, Alfred North Whitehead, and Charles Hartshorne.

Rāmānuja [a south Indian Brahman, born 1017, died 1137] employed a “body-self analogy” (Ninian Smart, 1967, p. 65) to conclude that the universe/cosmos is the body of the all-inclusive supremely intelligent divine self. Centuries later, in his famous “essay in cosmology,” Whitehead came to a similar conclusion via a “philosophy of organism” (p. 7) attentive to creatures and creativity as such (1927-28 Gifford Lectures). And with attention to Whitehead’s account of creativity and creative synthetic processes, Hartshorne employed a neoclassical-nondualist-Plato-instructed “mind-body analogy,” along with “mind-nerve-cell” analogy, and “person-to-cell analogy” (1984, pp. 52-63). Rāmānuja, Whitehead, Hartshorne, and Hoyle and Wickramasinghe agree that there are astrobiology-based reasons for affirming the theological idea of a living-divine universe with all-inclusive/all-embracing intelligence.

Intermediate Intelligences

To the longstanding panentheistic idea of divine all-inclusive intelligence, Hoyle and Wickramasinghe added a speculative supplement: “intermediate intelligences” (Hoyle 1984 [c1983], p. 215), meaning intelligences intermediate between divine and human. Between the “exceedingly high” “measure of intelligence” needed to control the coupling constants of physics (1981b, pp. 141-43) and human intelligences, there may be various intermediate intelligences. An intermediate intelligence could be vastly-astronomically greater than any human intelligence, and vastly-astronomically less than universal-divine.

Hoyle and Wickramasinghe recognized that *not* every conceivable intelligent control of an astrobiological process has to be divine control. For example, they speculated that an intermediate intelligence [perhaps a silicon-based intelligence (1981b, p. 139)] did the less complex work (work less complex than controlling the coupling constants) of designing the biochemicals that gave rise to carbon-based life (1981b, p. 143; also Hoyle, 1984 [c1983], pp. 226, 236-237). Similarly, concerning intelligent control over astronomical processes, Hoyle wrote:

It would seem to me that if the miniscule Earth can produce a creature with our own measure of intelligence, the whole galaxy should be able to manage an intelligence to which the manipulation of astronomical processes would be reasonably straightforward.
(Hoyle 1980, p. 23)

A whole galaxy or galactic intelligence manipulating galactic processes would not qualify as divine because divinity requires universal intelligence and universal influence. Instead of being universal and divine, a galactic intelligence would be an intermediate intelligence, a vastly less-than-universal and still vastly greater-than-human intelligence. A galactic intelligence would be an intermediate extraterrestrial intelligence.

Intermediate Extraterrestrial Intelligences

Recognizing the possibility of intermediate intelligences should encourage expanding the search for extraterrestrial intelligences beyond our present method. Listening for coded radio signals is searching for signs of relatively-near-to-human intelligences. According to Hoyle and Wickramasinghe, coded radio signals are not signs of vastly greater intelligences, such as a galactic intelligence, or the intermediate intelligence that “calculated the properties of the enzymes” (1981b, p. 144). An enzyme-calculating intermediate intelligence is not likely to be detected with a radio telescope. For detecting signs of vastly greater intelligences, Hoyle and Wickramasinghe prescribe alternative search methods such as studying the DNA of yeast cells, and studying the “whole process of consciousness” (Ibid, p. 145).

7. Panentheism requires generic panspermia.

As advanced by Hoyle and Wickramasinghe, biology and astronomy converged toward cometary panspermia, and toward implicit (1980) and explicit (1981b) affirmative theology. From the theological side of this convergence, in addition to espousing “all-embracing intelligence” (Hoyle 1984 [c1983], p. 215) [religiously spoken of as “omniscience”], panentheism embraces panspermia, though not necessarily *cometary* panspermia.

Cometary panspermia is a specific variety of generic “*panspermia*” (Anaxagoras [born c. 500-480, died 428]). [Another variety—spaceship panspermia—is said to be “wholly dead-and-done-with” (Hoyle, 1984 [c1983], p. 160). Also, “planetary panspermia” sometimes labels Lord Kelvin’s 1881 idea of colliding planetary fragments circulating plant seeds; which Wickramasinghe describes as “a relatively unimportant route” (Wickramasinghe, 2001, p. 178).] If, contrary to present evidence, we discovered that bacteria and viruses never travel by comet; this discovery would falsify cometary panspermia, but not generic panspermia.

According to generic *pan-sperm-ia*, all parts of the universe [*pan*] are *seeded* [*sperm-ia*] with the possible emergence, flourishing, and perishing of life.

Conceiving that <all parts of the universe are seeded with possibilities for life> is essential to conceiving of an omnipresent and eternally creative Creator. Hence, neoclassical panentheism requires generic panspermia; and, given present factual evidence, this author favors cometary panspermia.

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Lamarck and Panspermia - On the Efficient Spread of Living Systems Throughout the Cosmos. Progress in Biophysics and Molecular Biology, Vol. 149, Issue. , p. 10. CrossRef. Google Scholar. Full text views reflects the number of PDF downloads, PDFs sent to Google Drive, Dropbox and Kindle and HTML full text views. Total number of HTML views: 0. Total number of PDF views: 0 *. New discoveries in astronomy and biology continue to point to Panspermia as the most likely mode of the origin of life on Earth. This paper builds upon the work done by W.M. Napier, 2004 1 , and re-estimates the time for the seeding of the galaxy given the latest 2013 estimates from the Kepler Mission data. We present this "thought experiment" in the form of an opinion paper. In our view the totality of the multifactorial data and critical analyses assembled by Fred Hoyle, Chandra Wickramasinghe and their many colleagues since the 1960s leads to a very plausible conclusion - life may have been seeded here on Earth by life-bearing comets as soon as conditions on Earth allowed it to flourish (about or just before 4.1 Billion years ago. The Panspermia Theory asserts life came to Earth on meteors. Find out more about this theory and how it is still supported today. The Panspermia Theory is still supported today by several influential scientists, such as Stephen Hawking. This theory of early life is one of the reasons Hawking urges more space exploration. It is also a point of interest for many organizations trying to contact intelligent life on other planets. While it may be hard to imagine these "hitchhikers" of life riding along at top speed through outer space, it is actually something that happens quite often.