HADEAN LIFE

We have observed nothing but the natural product of the forces originally possessed by the substance of the universe. —aphorism concluding Huxley's *On a Piece of Chalk*, 1868.[1]

L21 Whence bacteria? < problem with viruses >

What do baths bring to your mind? Oil, sweat, dirt, greasy water, and everything that is disgusting. Such, then, is life in all its parts, and such is every material thing in it.
—Marcus Aurelius, *Meditations*, 2nd century.[2]

Seawater contains viruses in shocking abundance–hundreds of millions per millilitre. —Lane.[3]

By 3.5 Ga, some bacteria had evolved to utilize sunlight and were producers. Coincidentally, other bacteria would have evolved to be consumers with metabolisms based on fermentation (an anaerobic process that breaks down sugars and starches to release their energy, and produces carbon dioxide and alcohol or lactic acid as waste products wastefully! as these still store abundant energy that aerobic metabolism can release, making dubious any wish for wine and yogurt weight loss diets).

Fossils of bacterial life are in the oldest rocks that could conceivably bear them. These rocks are 3.8 Gy. No fossils exist of what can be claimed to be Earth's very first life, as Early Archean rocks that survive are not suitable bearers. No Earth rock has yet been found for the 0.5 Gy of the Hadean (a duration that equals that of the Phanerozoic).

According to evolution theory, bacteria evolved from less complex forms. Simpler are viruses but could these be candidates for consideration? Today, viruses (of their many diverse families)[4] can reproduce naturally (***Footnote L21.1***) only within a more complex non-viral host, and outside a host cannot live (metabolize) but, when on their own, become completely dormant.[5] If this was always so, viruses are not intermediate to bacteria in the evolutionary sense. Whence bacteria?

A model for the earliest organisms is that they were anaerobic heterotrophic microbes. At the beginning, their nutrient source was probably accumulations of ATP (adenosine 5'-triphosphate) inorganically synthesized from simple gases and phosphate. From ATP consumers, evolution involving life and its effect on the environment, bootstrapped bacteria and a supportive world.

Sun in its T-Tauri stage before 4.2 billion years ago was 30% dimmer. But, as Carl Sagan noted, "Earth did not begin frozen." His "Faint Young Sun Paradox" solution was that stony planets have very-high original levels of atmospheric CO_2."[6] However against such in Earth's Archean atmosphere, Minik T. Rosing, points to"the ubiquitous presence of mixed-valence Fe(II–III) oxides (magnetite) in banded iron formations."[7] He hypothesizes that the low albedo of an Archean Earth waterworld and a lack of biologically induced cloud condensation nuclei kept the ocean from freezing. Young Sun's radiations had a greater component of UV light although the total flux at wavelengths less than 230 nanometres was as reaches the edge of Earth's atmosphere today. Short UV wavelengths can bring into being small precursors such as formaldehyde. In the absence of an ozone shield, the long UV wavelengths would have reached to Earth's surface with sterilizing intensity. However, natural sea-surface sunblocks could have been.[8]

The hydrogen-rich conditions of hydrothermal vent life in their shelter of ocean dark, discovered in the 1980s, yields to "ventists" clues to prebiotic synthesis of life's components. Controversy focuses on the large temperature gradients as a plus, or not, as Christopher Wills & Jeffrey Bada review in *The Spark of Life: Darwin and the Primeval Soup*, 2000.[9] Whatever, genetic evidence suggests that the last common ancestor to all life was a thermophile.[10] ❑

Footnote L21.1 Viruses can be assembled in the laboratory using a two step process that begins by assembling a strand of synthetic DNA with the appropriate sequence of nucleic acids (a run of the mill procedure) and then using an enzyme to convert this to viral RNA that, placed in a mixture of organic chemicals of the cells which the virus usually targets, self-assembles into the complete virus.[11] In 2002, Eckard Wimmer announced the first laboratory made virus from its script published on paper, was that of polio.[12] Some have been engineered to kill specific cancer cells. In 2003, Craig Venter announced that just three weeks were taken to assemble a virus that infects bacteria.[13] At the same time, bacterial cells are being "rewired" to perform functions they can't fulfill in nature. "And researchers are getting close to determining the smallest set of genes necessary to support a living cell, which might make it possible to cook up new life forms," wrote Philip Ball in 2004.[14]