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## Genesis: By air or by sea?

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In the beginning ... what? A methane-ammonia atmosphere, zapped by lightning that, when combined with the oceans, formed a great, primordial, organic soup? Clusters of amino acids, washed ashore, that gradually mustered all they needed to grow and reproduce and finally became a self-sustaining cell? Probably, say most biologists.

No, says Carl R. Woese. In the beginning, it was all up in the air — literally. In the beginning, he says, there was no ocean; it was too hot. In the beginning, he told a recent workshop on the origin of life, when the earth's atmosphere was a cooler version of Venus's today, dusty, saltwater droplets in the heavy, swirling clouds collected prebiotic chemicals. Trapping sunlight to fuel their primeval metabolisms, using their vast, membrane-like surfaces, they created more chemicals. Gobbling up carbon dioxide and hydrogen, yielding methane and water, they broke the balance that maintained the greenhouse atmosphere. It cooled and it rained, and the droplets, already cell-like, fell into the embryonic ocean.

Woese's theory, needless to say, represents a major break from the prevailing, earthbound thinking about the origin of life. Though the University of Illinois at Urbana biologist's talk did not garner unanimous approval, "the feeling is that we were at the hatching of a really important scientific idea," says K. E. Van Holde, co-organizer of the NASA-sponsored meeting at the Woods Hole Marine Biological Laboratory in Massachusetts.

The airborne droplet theory, Woese told *SCIENCE NEWS*, represents an offspring of his earlier research, which showed that methanogens (methane-producing bacteria) may be among the earliest, if not the earliest, bacteria (SN: 11/12/77, p. 310). His theory neatly incorporates several appealing and increasingly accepted ideas — a Venus-like atmosphere for early earth, methanogenesis as the first metabolism, the droplet as a natural definition of the cell, the importance of membrane-associated reactions to life. Particularly intriguing, Van Holde notes, is the idea that the development of life halted the "runaway greenhouse" atmosphere by breaking down CO<sub>2</sub>. "It really means that the whole world is as it is today because of life," he said.

But other parts of Woese's theory don't sit well with some researchers. Most scientists, for example, believe the first organisms absorbed all their nutrients from the environment. Woese suggests that they were, in some sense, photosynthetic. Modern photosynthesis, as Van Holde points out, is a sophisticated process. However, unpublished research by Allen J. Bard and Harald Reiche of the University

of Texas shows that titanium dioxide and platinum in solution with water, ammonia and methane can capture and use sunlight to produce amino acids. Were similar "semiconductor" particles caught up in Woese's droplets, they may have created primitive photosynthesis.

Other researchers dispute the backbone of the theory — the suggestion of airborne droplets. Droplets or aerosols,

because they are unstable, are "conductive to destruction, not creation," says Lynn Margulis of Boston University. While she agrees with much of Woese's theory, Margulis points out that no now-living species could survive a lifetime suspended in a very hot, steamy atmosphere, "like an autoclave." "It is more likely," she says, "that life arose under conditions conducive to it now." □

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## Self-made cocoons protect tumors

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One of the most distressing characteristics of cancer is the apparent failure of the body's immune system to combat the run-amok cells. Cancer tumors seem remarkably able to elude, or delude, the natural defenses that manage to ward off most other diseases.

Now, studies at Massachusetts General Hospital in Boston of two types of induced cancer in guinea pigs suggest that some tumors may avoid the immune system by wrapping themselves in fibrin cocoons of their own creation and by manipulating the host defense system for their own use. Noting that the research, summarized in two papers in the June *JOURNAL OF THE NATIONAL CANCER INSTITUTE* and the *JOURNAL OF IMMUNOLOGY* (122: 166-174, 1979), used experimentally induced cancers and guinea pigs, the investigators caution against prematurely generalizing their findings to other tumor systems. Since publication, however, researcher Harold F. Dvorak told *SCIENCE NEWS*, similar fibrin sheaths have been found surrounding human tumors.

Intrigued by cancer's immunological imperviousness, Dvorak, his wife, Ann M. Dvorak, and co-workers decided to study the physical boundary between the tumor and the host. They injected guinea pigs, whose immune response is similar to humans', with cells from two strains of guinea pig tumors. In each case, the researchers noted the growth of a translucent gel-like coating made of fibrin strands around the tumor cells. The fibrin gels occurred around the tumors regardless of the conditions under which the cells were introduced and did not grow around non-

cancerous cells injected into the animals. Though such deposits occasionally had been noted previously, Dvorak said, their extent had been underestimated due to lack of techniques such as immunofluorescence and electron microscopy.

Noting that the fibrin sheaths appear similar to deposits formed by the activation of a clotting agent in the blood called fibrinogen, the researchers tested cultures of the tumor cells for such an activator. Indeed, the cells were found to produce a fibrinogen activator. Moreover, the investigators discovered, the tumor cells produce a factor that alters blood vessel permeability, a plasminogen activator (plasminogen is the blood component that dissolves clots; plasminogen activators were discovered in tumor cells as early as 1925) and a substance that halts the onslaught of macrophages.

The discovery of the four mediators suggests the mechanism for growth of the fibrin cocoon. According to Harold Dvorak, the vessel-permeability-altering substance causes the blood vessels around the tumor to leak, releasing plasminogen and fibrinogen. As the tumor-secreted activator causes the fibrinogen to form the fibrin cocoon, the plasminogen diffuses through the sheath. On contact with the plasminogen activator in the tumor cells, the plasminogen begins dissolving the gel from the inside, which allows the tumor cells room to grow. Shielded inside the expanding fibrin gel and warding off macrophages, the tumors act "as sophisticated parasites," say the researchers, "turn[ing] the host defense system to their own advantage." □

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## Health in women and women in health

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"The plain, indefensible truth is that ... women are second-class citizens in all aspects of the health care system" — so Sen. Edward M. Kennedy (D-Mass.) opened the August 1 hearing before the Senate health and scientific research subcommittee on women in health and science. Kennedy lambasted current health insurance programs that "often tie coverage of married women to their relationships with their husbands." He then cited recent studies in the *JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION* (241: 2186-2187) showing that male physicians take medical illness more

seriously in men than in women, and that they give men more extensive medical examinations. Finally, Kennedy condemned the condition of women scientists in the United States, where unemployment among them is five times higher than among their male counterparts. "Less than 10 percent of the nation's physicians, 3.4 percent of the dentists, and only 11.9 percent of the pharmacists are women," said Linda Ray Murray of Chicago's Cook County Hospital.

Sidney M. Wolfe, head of the Public Citizen's Health Research Group, took Ken-