In the beginning, perhaps cyanide

Life on earth may have been born in a thick, protein-rich stew rather than in a thin consommé of amino acids, says Clifford N. Matthews of the University of Illinois in Chicago. His controversial hypothesis suggests that first hydrogen cyanide was created from methane and ammonia found in the earth's primordial atmosphere. Clouds of hydrogen cyanide then rapidly polymerized to produce a complex mixture of long-chain molecules that settled into the earth's oceans and reacted with water to form proteins. This scenario differs markedly from other, more widely accepted theories that propose the formation initially of amino acids from which proteins were later built (SN: 1/31/81, p. 72).

Although Matthews has for almost two decades advocated his view that proteins were created before amino acids, until recently he lacked direct evidence that hydrogen cyanide polymers could actually be converted to polypeptides or proteins. The polymer mixture, "an intractable, brown-black, tarlike solid," he says, had hitherto proven to be difficult to characterize. Last week at the American Chemical Society meeting in St. Louis, Matthews and graduate student Robert Ludicky presented evidence that they said confirmed the presence of peptide bonds in hydrogen cyanide polymers after treatment with water.

The technique that finally penetrated the black tar was a combination of isotope labeling and nuclear magnetic resonance (NMR) spectroscopy. After labeling the starting materials with the isotopes carbon-13 and nitrogen-15, the researchers determined the composition of the hydrogen cyanide polymers before and after treatment with water. This determination was made using a new method called "double-cross-polarization" NMR, developed by Jacob Schaefer and his colleagues at the Monsanto Co. in St. Louis. The NMR results, Ludicky and Matthews say, show the presence of new carbon-nitrogen bonds after water treatment "that can be unambiguously ascribed to peptide linkages."

Not everyone finds the new evidence convincing. Sidney W. Fox of the University of Miami in Coral Gables, Fla., points out that there are all kinds of tests for peptide linkages. "Why did it take so long to get any evidence?" he asks. Yet, Fox concedes, "Basically, I think there is nothing wrong with [Matthews' idea] as a possibility. I couldn't say there wouldn't be more than one way to get proteins." Whether the small number of peptide bonds detected by Matthews indicates that proteins for the most part formed in the way that he postulates, however, is still an open question. Peptide linkages form easily under a wide range of conditions, says Fox. "I'm not surprised he found some."

Cyril A. Ponnamperuma of the University of Maryland in College Park has a more fundamental objection. He says Matthews' hypothesis "is an interesting suggestion but probably one that is much too complicated." The logical approach is to build up more complicated structures like proteins from simple building blocks like amino acids, he says. Philosophically, it seems more likely that the simple structures came before the complicated ones.

Nevertheless, Matthews finds his new results encouraging. "We're in a whole new stage of experimental work," he says. "We think our model makes a tremendous difference to the whole story" of the probability of life in the solar system and in the universe. Matthews speculates, "Polymerization of hydrogen cyanide may be the truly universal process underlying the possible... widespread existence of life."

—I. Peterson

Looking out for animal research

While animal welfare and animal rights groups continue to press for legislation to restrict research on laboratory animals, the National Institutes of Health (NIH) is mounting an effort to protect animal research, of which it is a major sponsor. The institute this month proposed several changes in its animal welfare policy that may head off proposed restrictive legislation promoted by animal protectionists. These changes and other issues of animal use in biomedical research were discussed last week at a meeting held in Washington, D.C., by NIH.

"It is a matter of deep concern that public support for laboratory experiments involving animals may be eroding," NIH director James B. Wyngaarden said at the meeting. "The critics of the PHS [Public Health Service — of which NIH is a part] policies — some of whom are attacking biomedical research on animals as not only inhumane but unnecessary — appear to be sincere and politically sophisticated. It is therefore incumbent on us to strive to build a wider consensus concerning the policy for humane care and use of laboratory animals and to initiate vigorously procedures to ensure that our policies will be implemented."

The proposed changes in the Public Health Service policy on laboratory animal use comes out of the increased interest of the public and the biomedical community, as well as the results of 10 recent site visits to institutions receiving NIH funds, William F. Raub of NIH said at the meeting.

Specifying who within a research institution has responsibility for animal use is one aspect of the proposed changes. Another section more clearly defines the composition and role of institutional animal research committees. These committees are intended to be the principal advisory group on humane care and use of animals, defined as live vertebrates. The proposed policy says that PHS will not award any grant unless the responsible institutional official verifies that the research plan has been approved by the animal research committee.

The proposal states that the committee must include a member not affiliated with the institution, the institution's attending veterinarian, a practicing scientist experienced in laboratory animal medicine and a non-scientist. The revision also proposes that a majority of the committee, rather than just the chairperson or the veterinarian, must approve use of animals in specific categories of experiments, including those using harmful invasive procedures, prolonged restraint or chronic disease. In the proposal the committee gains the authority to "terminate" a research activity if it cannot comply with the PHS policy. However, NIH can grant a waiver in "exceptional circumstances."

Some of the guideline revisions, which are open to public comment through July 15, conform to or even go beyond portions of the NIH reauthorization bill (HR 2350) passed by the House of Representatives last year. "NIH is ahead of us," Rep. Doug Walgren (D-Pa), who sponsored the animal welfare measures as an amendment to the bill, told the meeting. The House bill would require an institutional animal care committee, including a veterinarian and a member not affiliated with the institution, but not a non-scientist. The NIH reauthorization bill is now stalled in the Senate by other controversial sections, especially a portion on fetal research.

"We do not want to single out NIH but it [the reauthorization bill] was the legislative vehicle," Walgren says. He would like rules to extend eventually to animal research not funded by NIH. Currently NIH supports 37 percent of U.S. biomedical research, William I. Gay of NIH reports.

Other legislative measures have been proposed that would be more restrictive. Some, in addition to specifying humane treatment of laboratory animals, include plans to reduce the number of animals used.

The proposed changes in the PHS policy do not satisfy many of the animal protectionists. "Even once they [the guidelines] get changed, lots of things are only paper requirements," says one critic. "We need some sort of enforcement mechanism, before I can rest easy."

—J.A. Miller