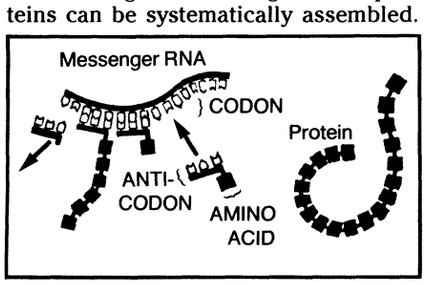
Is there a cosmic chemistry of life?

The genetic code in life on earth may reflect a universal chemistry — one essentially consistent throughout the cosmos, according to Cyril Ponnamperuma, director of the Laboratory of Chemical Evolution at the University of Maryland in College Park. In fact, he says, new experimental data from his laboratory suggest that the formation and linking of life's building blocks — amino acids and nucleotides — may have been all but inevitable, given the starting chemistry of earth's "primordial soup."

On the basis of these data, reported last week in Anaheim, Calif., at the American Chemical Society's fall national meeting, Ponnamperuma now believes that "if there is life elsewhere in the universe, chemically speaking it would be very similar to what we have on earth."

The Maryland experiments show "an intrinsic relationship between the molecules that make up the [genetic] code and the amino acids, which the code regulates," he says.

Proteins consist of amino acids that have been assembled according to a pattern specified in DNA's genetic code. The pattern used for synthesizing the proteins is copied from the DNA template onto RNA, in a series of linked three-letter "words" known as codons (see diagram). The ordering of the codons in this RNA, called messenger RNA, is the blueprint for building a protein. For each codon there exists a corresponding anti-codon — a three-letter fragment of RNA that fits hand-in-glove into its complementary codon. Amino acids are attached to the end of a different type of RNA molecule — one that has an anti-codon embedded within it. Once each anti-codon links up with its complement codon along the messenger RNA, proteins can be systematically assembled.



Courtesy: Ponnamperuma

This organization has been known for many years. What hasn't been known, Ponnamperuma says, is precisely why particular anti-codons and amino acids pair up. In nature, the pairing is always well defined. For example, an anti-codon made from three adenine bases (AAA) links up with the amino acid phenylalanine. An anti-codon made from three uracil bases (UUU) links up with the amino acid lysine. Some have suggested that the natural association between these molecules represents some quirk of early evolution — and one possibly unique to earth — that has been passed down.

But the new Maryland experiments, Ponnamperuma says, now indicate that not only the chemistry of these molecules, but also their physical structure, draws them to each other. For example, recent experiments by Nalinie Senaratne (now at Ruhuna University College in Galle, Sri Lanka), performed as part of her doctoral dissertation research, indicate that although a nucleic acid's subunits (a sugar, phosphate and bases) can be linked in many ways, only those with the specific three-dimensional structural orientation common to the nucleic acids in earth's living systems — DNA and RNA — show a statistical preference for pairing off with amino acids. Moreover, anti-codons show a stronger affinity for the amino acids they link up with in living systems than for other amino acids — an affinity sometimes 10 or 20 times greater.

Ponnamperuma says these observations suggest that if the laws of chemistry operating on earth hold constant throughout the universe, one might expect that wherever these chemicals coexist, they will preferentially link to form the same subunits that define the essential building blocks of life on earth. In other words, the ordering of the genetic code does not appear to be an accident or quirk of nature, he says, but instead a manifestation of the logical rules by which chemistry operates — rules that would operate not only in living systems but also in nonliving ones. By extrapolation, he says, this suggests that the genetic code seen operating throughout life on earth may be repeated elsewhere in the universe.

Adding support to this contention is the recent identification by Ponnamperuma and others of amino acids and DNA bases in meteorites that formed elsewhere in the solar system (SN:8/2/86,p.71).

Mitchell Hobish, for many years a coworker at Maryland with Ponnamperuma on these studies, says he believes these experiments indeed "indicate that there is a physical, structural and chemical basis for the genetic code." The goal, he says, is to find the origins of life by identifying what original combination of molecules and conditions led to the development of a self-replicating system. "Our spark-discharge work [SN:9/3/83,p.150] has shown indications that virtually all of the building blocks of bioorganisms can be produced abiotically," notes the biochemist, now a private consultant based in Baltimore. "Whether these building blocks can hook up to make the more complicated molecules [seen in living systems] has not yet been established," Hobish says. However, he told SCIENCE NEWS, "all the data we have indicate that we're on the right track."

Since 1971, James Lacey and his colleagues at the University of Alabama at Birmingham have been acquiring somewhat different but related chemical evidence linking anti-codons and amino acids to the development of the genetic code and to protein synthesis. "We were the first to present data correlating [chemical] properties between amino acids and their anti-codons," Lacey notes. Referring to the Maryland studies, he says, "We are pleased that their data lend such convincing support to that model." *— J. Raloff*

TV coverage linked to teen suicides

Teenage suicides have received much attention on television in the past few years. Two teams of researchers now report that the tube may play an active role in these tragedies. Television news coverage and fictional movies about suicide, they say, appear to trigger a temporary increase in the number of teenagers who kill themselves.

While "imitation suicides" are widely assumed to take place, as in recent instances of clustered teenage suicides in several suburban communities, some researchers say the new studies do not yet establish a clear statistical link between television and the adolescent suicide rate.

The investigators involved in the projects, however, see important implications in the data, which were published in the Sept. 11 NEW ENGLAND JOURNAL OF MEDICINE. "[Our results] indicate that the national rate of suicide among teenagers rises significantly just after television news or feature stories about suicide," write sociologists David P. Phillips and Lundie L. Carstensen of the University of California at San Diego. This increase, they add, is proportional to the amount of network coverage.

The researchers examined suicide rates in the seven days following 38 stories or pairs of stories that appeared on the three networks between 1973 and 1979. The stories were a mixed bag, including pieces on the suicides of television actor Freddie Prinze, an unnamed teenage girl and a man who had murdered several people; features included programs on "suicide and teenagers" and "suicide and prison."

On average, in the seven days following a single suicide story, there were about three more suicides than would normally be expected. The total of 1,666 suicides following the 38 stories was 110 suicides greater than would otherwise have been expected. Suicides among teenage girls during the week-long "danger period" rose by 13 percent, in con-

trast to a 5 percent increase among teenage boys.

If the shows had mainly quickened the pace of suicides among teenagers who were already about to kill themselves, say the researchers, suicide rates would have dropped steeply after the observation period, but they did not. Seasonal variations in suicide, they add, were corrected for in the results.

In the second study, Madelyn S. Gould and David Shaffer of Columbia University in New York City followed suicide rates in the greater New York area two weeks before and after four made-for-television movies on suicide, in 1984 and 1985. An excess of six suicides, compared with the number predicted, occurred after three of the broadcasts. Projected nationwide, this corresponds to about 80 extra suicides linked to the movies among 10- to 19-year-olds.

The one movie not linked to an increase, says Gould, focused on reactions of surviving family members and included educational information about preventing suicide.

In an accompanying editorial, Harvard Medical School psychiatrist Leon Eisenberg says the studies indicate that "it is timely to ask whether there are measures that should be undertaken to limit media coverage of suicide." He notes, though, that suicide rates are importantly affected by individual risk factors, such as depression, alcohol and drug addiction and social withdrawal, and by other triggering events, including unwanted pregnancy, family crisis and loss of or rejection by an important person.

"I'm prepared to believe that cases of imitative suicide occur after television programs," comments Stanford University sociologist James N. Baron, "but it's difficult to establish that link statistically." For instance, he points out that the two new studies are unable to identify whether the teenagers who killed themselves actually saw the television shows in question. Other studies, says Baron, find varying effects of media coverage on subsequent suicide rates.

It is curious, adds sociologist Steven Stack of Auburn (Ala.) University, that the television programs in the San Diego researchers' study contain few instances of *teenage* suicide. Psychological studies, he says, indicate that people imitate the actions of others most similar to themselves. The effects of programs about teenage suicides may need to be studied separately, holds Stack, and compared with the impact of other types of suicide coverage, such as that focusing on the elderly or on celebrities.

— B. Bower

U.S. DPT vaccine trials look good

The combination vaccine against diphtheria, pertussis and tetanus (DPT) protects children against these killers, but the pertussis part of the triad has created its own victims — a small proportion of vaccinated children who develop permanent neurological impairment. The first details of U.S. trials of a new pertussis formulation developed in Japan have just been released. They indicate that the new vaccine, which has already done well in Japan and Sweden, may be safer.

The current vaccine is made of whole, killed cells of *Bordetella pertussis* bacteria. Side effects range from a few days of pain, swelling and fever to, in rare instances, lasting brain damage. The Japanese vaccine uses two partially purified proteins from the bacteria.

Two studies in the September AMERICAN JOURNAL OF DISEASES OF CHILDREN describe the use of the Japanese vaccine in U.S. children. At the University of California at Los Angeles, researchers compared reactions among 18- to 24-month-old children receiving their fourth DPT booster. Forty children got the new vaccine and 20 got the current one. The new vaccine caused significantly fewer side effects. For example, while 85 percent of the children receiving the current vaccine developed a fever, only 5 percent of the others did. The injection site was tender in all of the current-vaccine recipients, compared with 22.5 percent of the new-vaccine recipients.

In the second study, done at Vanderbilt University in Nashville, Tenn., 20 children aged 4 to 6 years and 20 toddlers aged 18 to 24 months were given DPT boosters made with the two proteins, and an equal number got the currently used shots. As in the UCLA study, the new and old vaccines boosted pertussis antibodies in approximately equal measures, and side effects with the new vaccine were significantly rarer than with the old one.

The studies, both groups note, are not definitive. Both were too small to indicate whether the more severe neurological complications are less likely with the new vaccine, and all subjects had received previous vaccinations without adverse reaction. Comments Alan Hinman, an immunization expert at the Centers for Disease Control (CDC) in Atlanta, "The results are encouraging but we're particularly interested in seeing results of vaccination in children younger than those in these studies." Hinman and a CDC colleague have estimated that 51 U.S. children a year suffer permanent brain damage from the current vaccine. *— J. Silberner*

Booze before birth: Caution is the word

Some children born to alcoholic mothers suffer an array of mental and motor deficits collectively known as "fetal alcohol effects." Using animal models, researchers are uncovering the fetal defects that may underlie such debilitations.

When pregnant rats are fed ethanol-loaded diets, their fetuses undergo abnormal brain development, according to a report in the Sept. 19 SCIENCE. During normal brain development, a delicate schedule of neuron proliferation and migration ensures the systematic construction of extremely organized brain structures such as the six-layered cerebral cortex. In the study, prenatal exposure to high ethanol levels seemed to upset this schedule in at least three ways.

First, the period of neuron generation started one day later and lasted two days longer in rat fetuses exposed to ethanol, compared with unexposed fetuses. The pregnant rats were fed an amount of ethanol equivalent to what a woman would consume if she drank more than a gallon of beer every day during her pregnancy.

Second, the number of cells generated on particular days of the gestation period differed in the exposed and unexposed groups, although the total numbers of neurons were comparable. On most days, fewer cortical neurons proliferated in the ethanol-exposed fetuses than in fetuses from the control group. There was, however, "an anomalous late surge in the generation of neurons in rats exposed to ethanol," reports Michael Miller of the University of Medicine and Dentistry of New Jersey in Piscataway.

Finally, the distribution of neurons generated during this late surge was highly abnormal. Cortical neurons arise in a zone around a fluid-filled cavity called the ventricle, and migrate from there to their specific cortical destinations. Miller observed that many of these late-surge neurons migrated to the "wrong" place.

What does a rat study say about the effects of alcohol on human fetuses? Miller says it suggests that similar developmental defects in the brains of human fetuses probably underlie the symptoms in children with fetal alcohol effects. Researchers agree that heavy drinking should be avoided during pregnancy, when fetuses have precise developmental schedules to stick to. But "precise safe levels cannot be extrapolated from animal research," comments Lyn Weiner, director of the Fetal Alcohol Education Program at the Boston University School of Medicine. Caution is advised, says Weiner, "but the danger of small amounts of alcohol has been exaggerated."

— I. Amato