

## EVOLUTION

# DNA Can Trace Evolution

The genetic code, deoxyribonucleic acid, may be able to unlock the story of the development of life and may open new insights into evolution.

► THE GENETIC CODE may soon be used to trace the steps of evolution back to the most primitive forms of life.

In the view of most scientists, the code contained in molecules of a substance known as DNA, deoxyribonucleic acid, is the chemical "language of life" that transmits the specifications of form and function to all living things.

The possibility that the code can unlock the story of how life developed in the past was reported at the American Association for the Advancement of Science meeting in Cleveland by Dr. Thomas H. Jukes, research biochemist at the University of California's space sciences laboratory in Berkeley.

Continued rapid advances in understanding the code, Dr. Jukes said, may open vast new insights for scientists interested in evolution by:

1. Providing a new chemical means for checking the accuracy of evolutionary theories based upon fossil evidence.

2. Yielding clues to life that existed before the earliest fossils, perhaps even as far back as the first living organisms on the earth.

3. Offering a new view of the basic mechanism of evolutionary changes in living species, showing that these changes may be triggered by random rearrangements in a single molecule and perpetuated by environmental forces.

Scientists are generally agreed that the deciphering of the genetic code will clear away much of the remaining mystery from the fundamental life processes as they exist today.

Looking toward the future, some scientists have also speculated that full understanding of the genetic code might some day give mankind effective control over many diseases and perhaps even over heredity itself.

Another powerful use for the code, according to the report from Dr. Jukes, will lie in the interpretation of the past, tracing the history of life from its earliest beginnings to the present day.

Enough is already known about the genetic code, he said, to begin the search for new clues to evolution.

As the scientist explained it, this search will hinge upon the relation between the genetic code and the living protein substances formed as a result of the code's "message."

Four chemical bases form the "letters" of the code, repeated thousands of times in triplet "words" to form each double-spiral DNA molecule. The DNA "words," in turn, dictate the way amino acids are linked together to form the proteins that are ultimately responsible for the construction of every living organism.

In the view of Dr. Jukes, the evolution of all living species is probably the result of changes that occurred and accumulated in the genetic code of DNA during hundreds of millions of years. A single change in a triplet "word" in a DNA molecule—resulting from cosmic radiations or some other stimulus—can alter the nature of a protein and produce a genetic mutation.

As yet, scientists cannot "read" the message of the DNA code itself.

But with the understanding of the relation between the DNA code and the resulting known amino acid sequences in proteins, Dr. Jukes said, comparison of similar proteins in various living species may begin to yield some historical clues.

For example, the scientist noted that red blood cells from horses and humans are identical for 129 locations on the molecular chain, but different for the remaining 17 scattered locations.

These 17 differences, Dr. Jukes said, are the probable result of evolutionary changes in units of the DNA genetic code.

Since fossil evidence points to a common ancestor for the human and the horse about 100 million years ago, it appears that a single evolutionary change in alpha hemoglobin may occur on the average of once every seven million years.

Carrying the comparison further, the scientist noted that there are 220 code differences between human hemoglobin and myoglobin (a form of muscle protein) from the whale. This may indicate a possible primitive protein ancestor for these two in existence more than one billion years ago.

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## GEOPHYSICS

## Anchoring of Continents

► THE CONTINENTS are anchored some 300 miles deep in the earth's mantle. They are not thin blocks drifting on a fluid mantle that starts only a few miles below the surface.

These are the opinions of Dr. Gordon J. F. MacDonald of the University of California's Institute of Geophysics and Planetary Physics.

Dr. MacDonald told the American Association for the Advancement of Science meeting in Cleveland that he had used an electronic computer to calculate how the earth might have formed and how it could have evolved since then.

He said observations of the amount of heat flowing from earth's deep innards and of earth's gravity, particularly as measured from artificial satellites, suggest that the continents extend downward to a depth of 300 miles. The temperature under oceans exceeds that under the continents by 100 degrees centigrade, or 180 degrees Fahrenheit,

over the uppermost 400 miles of the mantle.

This deep-seated temperature difference, Dr. MacDonald believes, produces a density difference that is compensated for by changes in the materials making up the continental crust.

In Dr. MacDonald's model, the heat from radioactive elements during earth's early history produced eight times as much warming as it does now. Earth therefore expanded then at a rate of 30 to 60 miles every billion years.

During the expansion fracture zones were formed through which melted material in the mantle could rise to the surface. According to this view, earth is now contracting at a slow rate.

The formation of the earliest continents was associated with this period of rapid expansion and extension of the crust. The continents then grew further by accumulation.

Dr. MacDonald noted that the distribution of earthquake epicenters along the borders of continents supported his theory of differences in earth's heat structure extending a few hundred miles downward.

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## ENTOMOLOGY

## Lightless Cricket World

► AT LEAST one creature sings and merrily hops around in a somber world of darkness—the cave cricket.

Deep in the cool dripping passages of Mammoth Cave, Ky., where darkness prevails all year round and temperatures stay constantly low, these spry little insects apparently eat, sleep, reproduce and carry on lives well regulated to endless night, Drs. Orlando Park and David E. Reichle of Northwestern University, Evanston, Ill., reported.

Strangely enough, the cave crickets, *Hadenocercus subterraneus*, go out of their caves at night to prey upon other insects of the outside world, the scientists told the A.A.A.S. meeting.

This may indicate that the cave crickets are governed by some "biological clock"—an inner time piece that helps them perceive changes in the physical environment.

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## GENERAL SCIENCE

## Science Agency Suggested

► ESTABLISHMENT of a Department of Science and Education in the Government's Executive Branch has been suggested for handling activities now administered by the National Science Foundation and the Office of Education.

Delphis C. Goldberg, staff director of the U. S. House of Representatives' Intergovernmental Relations Subcommittee told the American Association for the Advancement of Science meeting in Cleveland that a Department of Science and Education would be a "realistic and practicable arrangement."

He said he doubts that Congress would give cabinet status to an agency collecting the smaller science programs of existing departments, as has been proposed.

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