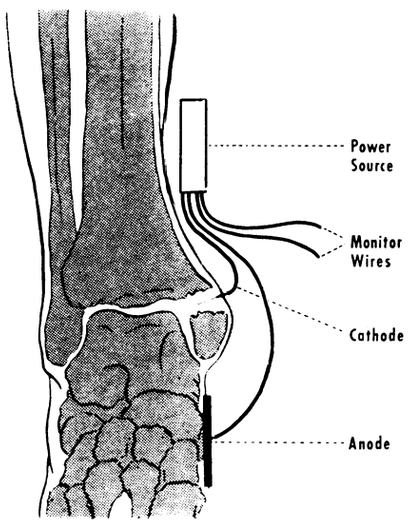
now being tried on two more patients whose fractures were stubborn about healing. The Pennsylvania orthopedic surgeons say the outlook is hopeful.

In all three cases, though, the fractures were without gaps in the bone. When current was applied to several patients with fracture spaces, healing was not stimulated. The investigators are now trying to see how they might get electric current to heal this kind of fracture. They also plan to undertake limited clinical trials, with double blind controls, to determine what electrical current does to fresh fractures.

Becker knows the Philadelphia investigators and respects their research. But he believes the clinical use of electrical stimulation in humans is premature.

"Our work [with rats] would seem to indicate that small electric currents are potent stimulators of cell activity," he told SCIENCE NEWS. "Neither our group nor any other to my knowledge has evaluated the possibility of inducing a malignant change in cells by means of electric current. That many cancer cells



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Philadelphia group's fracture therapy.

possess negative electric charges shows this possibility isn't farfetched. Until tissue culture studies and animal experiments show that electricity does not make cells cancerous, I would advise against applying electricity to human fractures."

In remarks prepared for the New York Academy symposium, he and colleague Joseph A. Spadaro reiterated this cautionary proviso, calling such applications to humans "unwarrented at this time."

Whether application in the clinical setting is premature or not, there seems little doubt that the work of both groups will offer valuable insights into the role of electricity not just in bone growth and fracture healing but in all kinds of tissue repair. □

How protein-like compounds could evolve in space

The hydrocarbon compounds on which life depends are too complex to form directly from their constituent atoms. They have to be the result of a series of steps of chemical combination. The nature of this series of events is an important question for scientists who are attempting to find out how life originated.

In 1953 Stanley Miller showed that amino acids could be formed from a mixture of inorganic substances that represented the supposed atmosphere of the primitive earth. But it is a long chemical way from amino acids to proteins. At the Southeastern Regional Meeting of the American Chemical Society in Nashville last week, Duane L. Rohlfing and Mary A. Saunders of the University of South Carolina at Columbia reported some laboratory work on intermediate steps in protein evolution. Among the conclusions it leads to is that protein-like compounds may exist outside the earth.

The next chemical possibility beyond the existence of simple amino acids are polymers called polyamino acids. Terrestrial proteins are polymers in various combinations of 20 amino acids called proteinous. In addition there are many amino acids called nonproteinous, which do not appear in protein compounds of life as we know it, but which can form part of compounds called protein-like. Amino acids of the nonproteinous variety have been found in samples from meteorites and in the results of the primitive-earth experiments.

The problem that Rohlfing and Saunders wanted to solve was whether these nonproteinous amino acids could coexist in the early stages of the evolution process. Could amino acids of both kinds form part of the same polyamino acid and were the proportions of amino acids found in the early experiments correct for the formation of polyamino acids? Rohlfing and Saunders took a number of polyamino acids formed by heating amino-acid mixtures and attempted to incorporate into them several nonproteinous amino acids alone and in combination with proteinous amino acids.

They found that all the nonproteinous amino acids they used could be incorporated into the polymers, though some went in more easily than others. They found important chemical similarities between polymers with and without nonproteinous amino acids. Says Saunders: "Those polymers containing only nonproteinous amino acids were composed of the same type of bond as those containing only proteinous amino acids, and the molecular weights were in the same range."

These chemical similarities indicate that proteinous and nonproteinous amino acids were linked together in the polymerization stage of the evolution of proteins on the primitive earth. "We conclude that the polymerization stage probably was not selective for proteinous amino acids," says Saunders. Some later process may have been responsible for sorting the proteinous amino acids from the nonproteinous ones. The basis of the separation may have been a difference in solubility, enzyme specificity, genetic selection or something else, but none of these possibilities yet has experimental support, she says.

When they used nonproteinous amino acids in the exact proportions reported by the earlier experiments that simulated primitive atmospheres the South Carolina investigators found that they did yield polyamino acids. "That these proportions yielded polyamino acids supports the concept of an evolutionary continuum from 'primitive-earth' gases to amino acids to polyamino acids," says Saunders.

Another result showed that the exact proportions of amino acids (including nonproteinous ones found in meteorite samples will polymerize thermally to yield protein-like compounds. "Because the moon and meteorites probably have a thermal history, our results are consistent with the possibility that protein-like compounds exist extraterrestrially." □

Cannikin's 7.0 explosion causes local damage only

In the wake of the furor over the Cannikin nuclear test on the Aleutian island of Amchitka, the explosion itself came as something of an anticlimax. None of the feared disasters materialized, and the Atomic Energy Commission was calling the test a complete success.

The five-megaton blast, which registered 7.0 on the Richter scale, produced many small aftershocks in the immediate vicinity of ground zero, but failed to set off a major earthquake or tsunami as feared by some environmentalists. Several large rockslides damaged the cliffs on the Bering Sea side of the island, and a few birds, sea otters, seals and fish were killed. No radiation leakage has been detected. The 800-foot-diameter underground cavity created by the blast collapsed Monday leaving a depression on the surface.

On the other hand, preliminary results indicate that the Spartan missile warhead being tested has met all specifications, and the AEC says further tests will probably be unnecessary. Indications are that Amchitka will be abandoned as a nuclear testing site. □