

1, its amino acids formed microscopic thread-like chains. These chains, some with 100 or more of little molecules joined together, were named proteinoids. The electric energies of their electric energies bent them with power to bend

the 20 kinds of amino acids to form the proteins of life, and in the order in which these are joined in the chains spells what they create—flesh or bone, or other. The scientists have learned to manufacture all these proteinoids under presumed primitive conditions. Dr. Kaoru Hagiwara is able to synthesize 14 in a laboratory experiment.

Answer to one question is that amino acids *by themselves* can form primitive protein-like molecules under certain conditions—without a cell to help them.

The final question remains: How did these proteins form in the first place, with its millions of molecules carefully arranged in a precise pattern?

Dr. Fox says that it took a long time before living cells appeared. He says that the precisely ordered present-day plants and animals have acquired their present arrangement in the many millions of years of evolution. Dr. Fox estimates that life must have evolved for many years *before* the first living cell appeared.

Dr. Fox says that this great leap, making a living cell in the lab-

oratory, may take a while. But it now appears that we've begun. The most striking experiment, which has produced crude cell-like spheres that maintain their identity and are capable of dividing themselves, is truly fantastic and has taken us a giant step along the pathway toward understanding the origin of life.

Again, the experiment was run by Dr. Fox. To reconfirm his laboratory findings, he climbed up the broad slope of a cinder cone in Hawaii, looking for spots where conditions might have permitted primitive proteins to form in the pre-life world. He was surprised to discover that large areas of the cone were oven-hot just beneath the surface. Might not this warm primitive earth have been the womb for the molecules of life—where they could bake and boil, before being washed through the loose lava by a cloudburst and so into the sea? What would this have done to the elemental amino acids?

Dr. Fox took hunks of lava back to the laboratory and placed on them amino acids coined from methane, ammonia and water. With everything sterilized to avoid contamination, he baked this concoction for a few hours in a glass oven at 338° F., the temperature he found four inches under the surface of the cinder cone. When the materials cooled, a brown, sticky residue was left clinging to the lava. He then deluged the lava with sterile water, and a brown soupy liquid resulted.

This unpromising stuff turned

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