

BIOCHEMISTRY

# Building Blocks of Life Ruled by the Number 288

## This Number and Its Multiples Found Everywhere In Groupings of Amino Acids to Form Proteins

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THE BIBLICAL number typifying man's length of life may be three score years and ten but the chemical number which permits him to attain that age is 288.

The chemical bonding of vital protein—basis of all living matter—is bound up with the cryptic number 288, Dr. Max Bergmann, research scientist from the Rockefeller Institute for Medical Research, New York City, disclosed before the recent meetings of the American Chemical Society in Richmond. Not only is 288 a number intimately connected with life itself in the higher animals—including man—but it is a number closely related with heredity and the ability of parents to transmit physical characteristics to their offspring.

### On Chemical Basis

Predetermination, said Dr. Bergmann, now takes on a new and understandable chemical basis instead of an interpretation of heredity in terms of chromosomes. Scientists called the chromosomes and the genes they contain, the bearers to posterity of the physical characteristics of those now living. But the names chromosomes and genes were after all but names rather than explanations of why they were endowed with their remarkable abilities.

The tissues of animals and man, besides containing a vast amount of water, consist mainly of proteins. Yet the structure of no single one of these basic, life-bearing proteins is exactly known, said Dr. Bergmann.

The trouble has been, he indicated, that proteins are the giants among chemical molecules. They owe their gigantic size to the complicated assembly of smaller chemical units which somehow form chemical families that are essential to life. The number 288 has recently been discovered, in Dr. Bergmann's laboratory, to enter into the chemical rules which determine how such complex molecular organizations are put together.

Chemical aggregates known as the ami-

no acids for a long time have been known to be members of the huge protein molecules, declared Dr. Bergmann. But the new finding is that in the protein contained in the chicken egg there exist groups of 288 of these amino acids. And in the protein found in the hemoglobin of cattle 576 amino units make up the molecule. This, significantly, is twice the cryptic number 288. Similarly the fiber protein of cattle blood contains 576 amino units, while the fiber protein that makes natural silk contains 2,592 amino units; or nine times the basic number 288.

### Protein Specificity

It was formerly thought, said Dr. Bergmann, that an almost infinite variety of proteins could exist. Dr. Emil Fischer, German Nobelist, had advanced such a theory whose implications pictured a protein for the hair of man, a different one for the hair of a dog, another for sheep hair and so on for each species of animal. And then the whole process was repeated for proteins in any other part of the body, again throughout the whole animal and plant kingdoms. By varying the combinations of only 30 amino acids, for example, it was possible to postulate the existence of 1,280,000,000,000,000,000,000,000

different proteins; or a number equal to 128 followed by 28 ciphers.

Analysis in Dr. Bergmann's laboratory, however, has brought new order out of this apparently jumbled picture. The only protein combinations permitted to exist in nature consist of those containing 288 amino units, or some simple whole number multiple of 288.

Out of his work, Dr. Bergmann has been able to fashion what might be called a mathematical rule for life, or at least the vital protein part of it.

### Formula For a Molecule

Says Dr. Bergmann:

"Proteins appear to contain  $2^m \times 3^n$  units per molecule, where  $m$  and  $n$  are whole positive numbers."

Higher animals, including man, are unable to build up the basic units of protein, but make them available by digesting food proteins by means of enzymes in the gastro-intestinal tract, such as pepsin and trypsin. Plants, in other words, have long been known to fashion the complex protein arrangements and man, by digestion, breaks these larger building blocks into usable pieces.

The first step in the new knowledge was the creation in Dr. Bergmann's laboratory of relatively simple peptide-like substances serving as simple protein models with which could be studied the action of the various enzymes. It was by the study of these synthetic protein models that the amazing regularity of 288 and multiples of 288 appeared.

Gradually it became apparent that enzymes had specific duties to perform and that, in fact, each kind of protein is created by the action of its specific enzyme. This fact, said Dr. Bergmann, is a new understanding of body chemistry for it had previously been supposed



### CITIZENS OF THE MOON

*It has been suggested that if any life larger than bacteria could exist on the arid, airless face of the moon, alternately baked in sunlight and frozen in darkness, it might be lichens. On earth, these strange plant communities endure where other plants perish, so if there are even crumbs of oxygen and moisture on our satellite, such things as these might conceivably live there.*