BIOCHEMISTRY

Protein Chain 'Unraveled'

Understanding the structure of collagen, the almost steel-like reinforcing material of bone, skin and tendons, may lead to a fundamental understanding of the aging process.

THE INTRICATE, spiral design of collagen, the most abundant protein in the human body, has been "unraveled" in the laboratory.

Collagen molecules form a fibrous material that occurs in bone, skin and tendons, acting almost like steel reinforcements. The strength of collagen comes both from the design of the individual molecules and from the way the molecules are linked together to form masses of material.

Studies at the California Institute of Technology, Pasadena, revealed that each collagen molecule consists of three spiral threads called polypeptide chains. The chains are wound together to form a "helix" of 35 turns, only an eighty-five-thousandths of an inch long.

"Such basic structural research as this is an essential adjunct to medical studies and also may lead to a more fundamental understanding of the aging process in general," said Dr. Alan J. Hodge in whose laboratory the work is being done.

In addition to being wrapped around each other, said Dr. John H. Fessler, senior research fellow at California Institute of Technology, the chains are linked together by hydrogen bonds that join side-by-side instead of end-to-end. This gives a larger contact area, and thereby makes stronger bonds. This same trick produces tough silk fibers.

When the molecules are combined together in large numbers, the resulting material gains strength from the fact that neighboring molecules are systematically offset, like rows of bricks in a wall, but with tiny spaces in between them. The spaces are only one and one-half millionths of an inch wide, and in bone they are filled with calcium phosphate, which has the same effect as cement in reinforced concrete.

Collagen molecules are too small to observe one at a time in detail, even with an electron microscope. Therefore, Dr. Fessler, with Dr. F. O. Schmitt of the Massachusetts Institute of Technology, Cambridge, grew his own supply of molecules in crystal form, in such a way that they were aligned together, instead of being offset. An electron microscope can see through a whole line of molecules at once, so lining up the features of the molecules made them intense enough to be visible to the instrument.

Analysis of photographs from the microscope indicates that two of each molecule's three chains are the same and consist of five identical polypeptide sub-units joined end-to-end. The third chain is made up of seven smaller identical sub-units of a different variety. All three chains, however, are the same length.

Each of the five sub-units in the two identical chains contains about 210 amino acid "building blocks," with about 150 in each of the seven smaller ones.

The next step, according to Dr. Hodge, is to "map" the sequence of amino acids in each of the two kinds of sub-units.

• Science News Letter, 87:227 April 10, 1965

BIOCHEMISTRY

Amino Acids Made Simply

➤ ONE OF THE MOST important "building blocks" of life, the amino acid, can now be produced by a simple technique.

The process, which requires only inexpensive materials, will provide a more abundant supply of amino acids. Since these substances combine to create protein molecules that are essential to nutrition and other chemical activities of the human body, their increased supply may have far-reaching effects on research.

The amino acid synthesizing process, developed at the General Electric Research Laboratory by organic chemist Dr. Herman L. Finkbeiner, can produce all of the 20 known amino acids, as well as amino acids not found in nature.

Studies of the process of normal nutrition, experiments in enriching certain foods with selected amino acids, and investigations of how chemical reactions proceed in normal and abnormal cells are expected, said Dr. Guy Suits, director of research.

Using the new technique, it should be possible to easily "tag" certain acids radioactively, in order to follow their progress as they take part in chemical reactions of the cell. Acids not found in nature can be specially created for such research.

Progress in the synthesis of amino acids and an increased understanding of their role in nutrition might lead to the creation of food supplements to economically upgrade low-quality diets for undernourished populations and "super" foods for those engaged in activities with specialized requirements, such as astronauts. Improved nutrients, perhaps administered intravenously, might also find application in the field of medicine, especially in the care of the elderly.

Synthetic amino acids may also prove valuable in the study of enzymes.

Enzyme chemistry is, essentially, the chemistry of the amino acids.

• Science News Letter, 87:227 April 10, 1965

BACTERIOLOGY

New Approach to Staph Seeks Lethal Component

➤ STUDIES TO DISCOVER the exact part of the complex staphylococcal cell that causes death could lead to an improvement in treatment.

Treatment is not always successful with antibiotics, a report in Nature, 205:1318, 1965, by University of Iowa scientists indicated.

Staphylococci are spherical bacteria that often look like a bunch of grapes under a microscope. They live on the skin and mucous membrane of the nose. Injuries to the skin, and other factors, such as malnutrition, sometimes allow the germs to get into the body.

Boils and carbuncles are the most frequent results, but if bone is invaded, osteomyelitis, a painful, crippling disease, results.

Staphylococci can also cause pneumonia and food poisoning.

The researchers disintegrated the staphylococcal cell and demonstrated the effect of the fractionated *Staphyloccus aureus* on male Swiss mice.

As little as 0.5 cubic centimeters of the protoplasm used killed the mice in five to seven hours. The mode of death was identical to that produced by live cells.

Further fractionation of the protoplasm components and an examination of their biological activity is in progress.

Drs. Ian M. Smith and Shirley S. Lindell of the department of medicine, and Dr. Joseph I. Routh of the department of biochemistry, University Hospitals and State University of Iowa, Iowa City, reported the study.

• Science News Letter, 87:227 April 10, 1965

General Electric

SYNTHETIC AMINO ACIDS—The white powder seen in the dark circle is the final product of the "bubble cap" fractionating column which is used to synthesize amino acids. Dr. Herman Finkbeiner watches the process which he developed for General Electric Research Laboratories.

Science Service, Inc. is collaborating with JSTOR to digitize, preserve, and extend access to The Science News-Letter. www.jstor.org