PHYSIOLOGY

Answer to Muscle Riddle

The question of how living muscles contract and relax subject of research by Hungarian Nobelist during Nazi persecution.

By MAXIM BING, M.D.

➤ THE QUESTION of how living muscles contract and relax seems to have been answered by research by Prof. A. de Szent-Gyorgyi of Hungary, winner of the Nobel Prize for his isolation of vitamin C.

The muscle research, finished by Prof. de Szent-Gyorgyi during severe persecution by German and Hungarian Nazis, was reported in full at a meeting of the Hungarian Society for Natural Sciences, the first public act of scientific life after Hungary's liberation.

Discovery of a previously unknown protein and its role in muscle contraction were reported by Prof. de Szent-Gyorgyi. He and his collaborator, Bruno Staub, named this protein actin.

Under certain conditions, actin forms filaments consisting of globular particles arranged in a string like the beads of a rosary. These actin filaments or strings of beads unite with another previously discovered muscle protein, myosin. Rod-shaped particles of myosin cling together side by side and at their ends adhere to the globules of the actin string.

When a potassium salt is added, the myosin is precipitated. The consequent shrinkage bends the actin string toward the side of the shrinking myosin. The shortening which follows is seen as muscle contraction.

The myosin particles are attached to the actin string in a spiral pattern which much resembles a winding staircase, the actin particles forming its axis and the myosin particles its steps. Through muscular contraction, the complete system assumes the shape of a corkscrew.

The cross-striation of voluntary muscles of the body is due to this spiral arrangement of the clusters of myosin-actin systems of which the muscle fibers are composed, Prof. de Szent-Gyorgyi reports.

This has been proved by rotating the muscular fibrils under the microscope. During such rotation, the cross striation moves along the axis of the fiber. This explains the difference between cross-striated muscle, such as that in the arms, and smooth muscle such as that of the heart. Inside smooth muscle, the actin-myosin systems are less closely packed and thus neighboring actin-myosin spirals differ in their phases.

The three known conditions of muscles, relaxation, contraction and rigor mortis (the stiffness of the muscle shortly after death), are accounted for by Prof. de Szent-Gyorgyi's findings. Like myosin, actomyosin is precipitated by potassium chloride. If this reaction is performed in the presence of another chemical, adenosintriphosphate, the actomyosin not only precipitates but contracts.

This precipitation and contraction is limited to a very narrow range of salt concentration, outside of which the actomyosin splits into actin and myosin. Furthermore, the range of concentration depends also on the adenosintriphosphate concentration. Very slight variations of either cause a transition of the dissociated (relaxed) system into the contracted one.

Relaxation of muscles corresponds to the dissociated actin-myosin system. Contraction of muscles corresponds to the associated one, while rigor mortis corresponds to the salt precipitation of actomyosin through decomposition in the absence of adenosintriphosphate.

Actin was discovered during investigation of what happened during a mistake, as scientists considered it, in extracting myosin from muscles.

The consistency of myosin differs considerably according to the duration of the process of extracting it. Short extraction yields a thin fluid. Prolonged extraction produces a jelly. Previous researchers usually discarded the jelly-like product, believing it to be the result of having "spoiled" the process of extraction.

Prof. de Szent-Gyorgyi, however, prepared filaments from the jelly-like product and immersed them in a muscle "soup," that is, a boiled extract of muscle tissue. The filaments from the "spoiled" extraction contracted vigorously. Prof. de Szent-Gyorgyi thus reproduced the vital function of muscle in the test tube and made it accessible for analysis.

Prof. de Szent-Gyorgyi's results seem to open new vistas for explaining the nature of wave excitation and the mechanism of neural action. They represent a new approach to one of the oldest and most important problems of biology. He has been invited by the Soviet government to give a number of lectures in Moscow about his fundamental researches.

Prof. de Szent-Gyorgyi

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VOLCANOLOGY—AERONAUTICS

Army Helicopter to Hover Over Mexican Volcano

➤ A U. S. Army Sikorsky helicopter will shortly hover over Paricutin volcano in order to discover for the joint Mexican-U. S. volcano commission secrets of this geological wonder that burst forth from a cornfield two and a half years ago.

In this scientific exploration the Army's Air Technical Service Command will study performance of the latest model R6A helicopter under conditions of high altitude, turbulence and temperature similar to those in the Pacific war theater which do not exist anywhere in the United States. While making the scientific flights, Capt. George D. Colchagoff and Flight Officer Roy P. Beer, with 200 hours of helicopter experience, will be investigating rescue, observation, supply and liaison uses of the helicopter.

The first helicopter to be used in scientific collaboration with any country has arrived in Mexico dismantled in a C47 Army transport so snugly packed that only one inch space remained. The