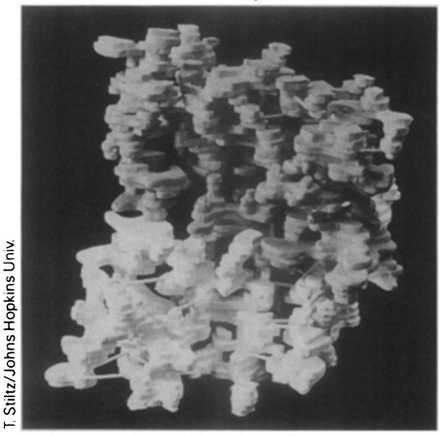
Energy converter's structure proposed

The energy to drive important biological processes such as muscle movement comes from the splitting of the adenosine triphosphate (ATP) molecule into an adenosine diphosphate (ADP) and an extra phosphate (P_i). Energy from food (in the case of animals and certain bacteria) or light (in the case of plants) then is used to re-form the power-packed ATP. While researchers long have known that the ATP-synthesizing portion of this cycle largely depends on a protein dubbed "F_1 ATPase," the details of that molecule's operation remain unclear. Now, in a study that may bring scientists a few steps closer to unraveling those details, Peter L. Pedersen, L. Mario Amzel and colleagues of Johns Hopkins University School of Medicine in Baltimore present the first three-dimensional model of F_1 ATPase.



T. Stiltz/Johns Hopkins Univ.

Balsa wood model of F_1 ATPase.

Pedersen and colleagues used data from X-ray crystallography — a technique that involves beaming crystals of a sample with X-rays and collecting the resulting characteristic pattern of scattered rays on a photographic plate — and other analyses to build their three-dimensional model, which represents a 9-Å resolution image of F_1 ATPase. Pedersen hopes the model — which is described in the October PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES — will provide clues about where on the F_1 ATPase molecule specific substances involved in the synthesis of ATP bind.

Scientists already have determined that the ATPase molecule sits on top of another protein called "F_0," which is embedded in certain membranes — in animals, for example, those found within mitochondria. On the other side of such membranes is a series of complex proteins called the electron transport chain. The job of this protein series is to use energy from food or light to split water, placing the resulting protons (H^+) on the transport chain side of the membrane and the hydroxide ions (OH^-) on the F_0-F_1 ATPase side. This achieves a battery-like charge separation. Protons then flow through a channel formed by the embedded F_0, attach to the F_1 ATPase and, finally, match up with hydroxide ions to re-form water — an energy-releasing chemical reaction. Meanwhile, ADP and P_i also have attached to F_1 ATPase; the energy released in the water-forming reaction is used to reunite these two components to synthesize ATP.

Precisely where the ADP, P_i and H^+ bind to F_1 ATPase is what Pedersen hopes to elucidate, using the model and data collected in future studies. Determining such details of natural energy-converting systems eventually could lead to improved versions of existing man-made correlates — solar power batteries, for example.

—L. Garmon

Type A personality: The physical response

The Type A — heart attack-prone — personality was well documented during the 1960s and 1970s as a time-urgent workaholic who succumbs to a heart attack in the wake of especially stressful life events. During the past several years investigators have turned to studying how the thoughts, emotions, and behaviors of this personality are translated, physically, into a heart attack. Their findings have suggested that it is by the overreactivity of specific bodily responses to specific life challenges. Now further indications that this is the case are reported in the Oct. 29 SCIENCE by Redford B. Williams Jr. and colleagues at Duke University Medical Center in Durham, N.C.

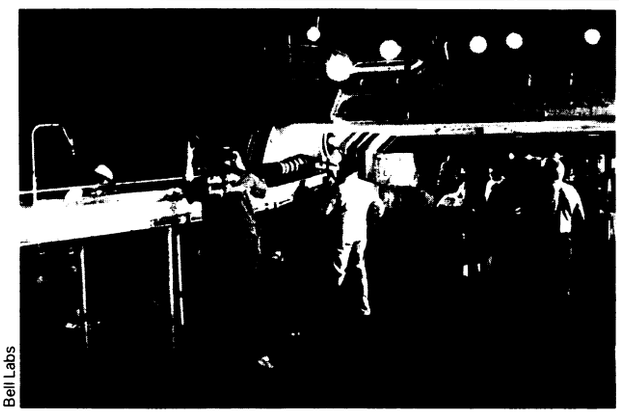
Williams and his team studied blood pressure and blood flow to muscle; they also studied the levels of five hormones — norepinephrine, epinephrine, cortisol, testosterone and prolactin — in Type A subjects and in Type B subjects (their calm, less competitive, non-heart-attack-prone counterparts) before and during two different tasks — mental arithmetic work and reaction time. They found that the Type A's, compared with the Type B's, produced certain excessive physiological responses to each of the tasks. On the arithmetic task, Type A's produced excessive blood flow to muscle and excessive levels of norepinephrine, epinephrine and cortisol. On the reaction time task, Type A's produced excessive levels of testosterone and, in those who had a history of high blood pressure, also excessive cortisol levels.

These findings, Williams and his coworkers conclude, "have potentially far-reaching implications for understanding mechanisms underlying the increased coronary disease risk observed among Type A persons." For instance, both cortisol and testosterone are known to encourage hardening of the arteries, a major risk factor for heart attacks. In fact, extensive evidence from other sources has shown that Type A's experience more severe hardening of the arteries than do Type B's. Epinephrine and norepinephrine, on the other hand, are known to increase blood clotting, and if a clot lodges in a coronary artery clogged with cholesterol, it could deprive the heart of oxygen and lead to a heart attack.

Meyer Friedman of Mount Zion Hospital in San Francisco, one of the pioneer researchers into the Type A personality and coauthor of the popular book *Type A Behavior and Your Heart* (Knopf, 1974), said he would like to see more studies along these lines. Such research has resulted, in large part, from the work of one of the major investigators into the physiological links between the mind and disease — Hans Selye of the University of Montreal. Selye, who died at his home in Montreal last week at the age of 75, identified norepinephrine and epinephrine as being the body's "fight or flight hormones" as well as two of its major mechanisms for dealing with stress. Over the short haul, Selye contended, such physiological responses are valuable to survival, but if they are deployed on a chronic basis they can set the stage for any number of diseases, including heart disease (SN: 5/31/75, p. 356).

—J.A. Treichel

Light waves communicate under the sea



Bell Labs

Bell Labs optical fiber cable, which will compete for the contract for a transatlantic connection, has successfully passed an ocean-bottom test at a depth of 18,000 feet, 900 miles off the New England coast. The system uses light waves of 1.3 microns wavelength to transmit messages. Here the cable is being paid off the stern of the cable ship Long Lines.

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