MEDICINE

Rubber Heart Devised

Implantable substitute human hearts may soon be made with silicone rubber, which is compatible with body tissue, flexible and easy to sterilize.

➤ RUBBER, which for years has been replacing various damaged and diseased human parts, is now being used to make substitute human hearts.

Silicone rubber, because of its flexibility, ease of sterilization and compatibility with body tissues, is the choice material for the implantable heart, reports F. L. Dennett of the Dow Corning Center for Aid to Medical Research, Midland, Mich. Hearts prepared from Dacron-reinforced silicone rubber have already been tried in calves, he said, and similar structures have been used to support the function of the human left ventricle.

"Before a successful artificial heart can be developed, a vast amount of very careful research must be done by the medical profession, but with increased Federal grants with special emphasis on heart disease, it certainly is possible that a total heart may be implanted in a human in a few years," Mr. Dennett said.

Only specially prepared medical grade silicone rubber is used for implants as distinguished from the conventional silicone rubber used by industry, he said. The medical formulations contain only insert fillers, nontoxic chemicals and materials that are removed during processing.

Since 1953, when their use for tissue replacements under the skin was first suggested, the silicone rubbers have been of increasing interest and value to medical researchers. Their variety of uses has extended from replacement of the bile duct to rebuilding the facial contour, from tendon protheses to repair of detached retinas, and from artificial heart valves to replacement of a membrane of the brain.

Mr. Dennett reported on the rubber heart at a meeting of the American Chemical Society's division of rubber chemistry in Miami Beach.

Most pacemakers, the devices used to artificially stimulate the heart, are encapsulated in silicone rubber. The rubber acts both as a physiological and electrical insulator.

"The application of medical grade silicones mentioned show that their degree of inertness, chemical stability within the body, their ease of handling, lack of tissue reaction and stability at extremes of temperature make them valuable candidates as tissue and organ substitutes," Mr. Dennett said.

• Science News Letter, 87:311 May 15, 1965

PHYSIOLOGY

Sprinters Burn Oxygen

➤ A SHORT, HARD BURST of exercise such as sprinting 100 yards or a quarter of a mile demands more oxygen than the steady lope of the long distance runner.

The extraordinary tolerance of muscle cells for a temporary shortage in oxygen supply is explained by two Dallas scientists in the Scientific American, 212:88, 1965.

They say that a substance called myoglobin found only in the muscle cells, appears to store oxygen, in marked contrast to hemoglobin, which surrenders oxygen more readily.

Drs. Carleton B. Chapman and Jere H. Mitchell of the University of Texas Southwestern Medical School, say that myoglobin may "conceivably serve as a special oxygen store for the cell." Partial pressures of oxygen in muscle cells may approach zero during very heavy activity.

Under fairly severe stress from exercise, moreover, the body can incur an "oxygen debt," which enables it to live temporarily beyond its capacity for transporting oxygen to active muscles and to compensate for doing so during rest after the exercise. Most people, even in slow walking, usually incur some oxygen debt that is paid off at various rates.

The body mobilizes its machinery as soon as a person senses that vigorous physical activity is imminent, the researchers explain. When exercise itself starts there is an "immediate jump in the rate of ventilation of the lungs."

The heart output, the pulse rate and stroke volume rise to their maximum level, probably within no more than a minute or two. At the same time the hemoglobin starts to surrender more of its oxygen to the muscle tissues, widening the difference between the oxygen content of arterial and venous blood.

"By the end of the first minute most of the known adaptive mechanisms are working nearly to capacity," the doctors say. "Thereafter, with continuation of the exercise, the muscle cells begin to run up an oxygen debt. If the exercise is pushed to the point of exhaustion, various mechanisms fail."

Practical objectives of research on the physiology of exercise might include the finding of training regimes that not only could raise physical performances to greater heights, but which might help the body to cope with diseases of the lungs and heart, the investigators conclude.

"In many ways," they say, "the symptoms of chronic heart failure are like those accompanying heavy exercise. . . . By acquiring a better understanding of the mechanism involved it may be possible to improve the body's adaptation to its needs."

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BIOTECHNOLOGY

New Model Heart Pacer Gets Energy From Heart

➤ A NEW WORKING MODEL of a heart pacer that requires no outside wiring or storage batteries was reported at a symposium of the Hahnemann Medical College and Hospital in Philadelphia. It gets its energy from the beating heart and stores it so that if the heart beat weakens, the stored charge is released to stimulate it to normal beating.

Two electrodes, each about the size of a nickel, are applied to the beating heart. The electrodes pass the heart's electrical output into an even smaller capacitator where it is stored for later emergency use.

Although tried on two patients whose hearts were being prepared for implant of the ordinary pacemaker, the model will require more work before it is ready for implanting.

Two graduate students, Harold L. Massie and Philippe Racine, in the biomedical engineering program at Drexel Institute of Technology, Philadelphia, are responsible for the model, which they reported along with Luther Reynolds, Hahnemann research biochemist, and Drs. Leonard Dreifus and Victor Satinsky, also of Hahnemann.

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Michigan State University

TEMPERATURE BY EAR — This ear thermocouple that records the temperature of the blood entering the brain is being used in tests conducted at the Naval Medical Research Institute by researchers from Michigan State University. More sensitive than traditional methods of recording temperatures, it is particularly useful where rapidly changing temperatures are critical.