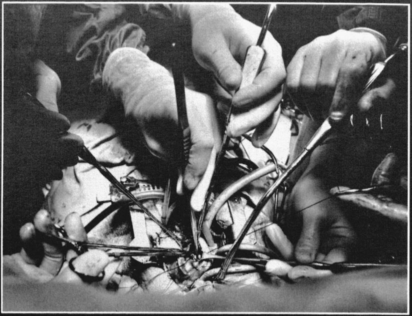


Skilled Medical Center team repairs heart valve of a four-year-old child.

# RESEARCHERS GANG UP ON HEART DISEASE

Around the world the public hears the beat of Philip Blaiberg's gift heart with tremendous interest. There is, after all, inherent drama in a human heart transplant, and there is, always, the hope that this is a major advance in the continuing fight against heart disease.

In the world of the physician, doctors hear Blaiberg's heart beat a different rhythm. Some critics decry the "circus atmosphere" of the first heart transplant operations in South Africa and Stanford and New York. Others say the operations have raised false hopes, that the body's ultimate rejection of foreign material dooms all heart transplant patients. Speaking on the Columbia campus earlier this year, Dr. Michael DeBakey, famous and sometimes controversial heart surgeon from Baylor University, pointed up the ethical problems involved, and suggested the long-run answer for heart disease is a cure or mechanical replacement.

Everyone, however, agrees that Dr. Christiaan Barnard's transplants on Louis Washkansky and Blaiberg were important scientific advances.

At the University of Missouri, no one suggests that the Medical Center at Columbia is ready to try a human heart transplant of its own. But research and treatment of heart disease are going forward on many fronts. In the past five years, grants supporting heart research at Columbia have totalled more than $1 million. They have gone to the Medical Center, including the School of Medicine; the Regional Medical Program, and the Ecology Field Service. Some of the work is dramatic; much of it is painfully slow and uncertain; all of it is important.

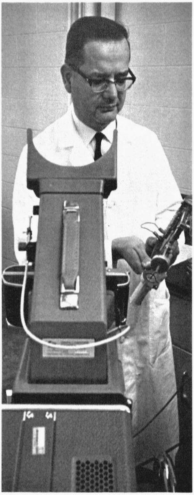
And heart transplants have a role. For the past 5½ years, Missouri researchers have been engaged in heart transplant activities in the dog. This work has been correlated with heart preservation studies which have included low temperature techniques. None of these preservation methods has proved entirely satisfactory, however, and the Medical Center is continuing its heart transplant program utilizing donor hearts which have been revived with mechanical ventricular assistance after being stopped for periods of from 15 to 60 minutes. This technique is working well.

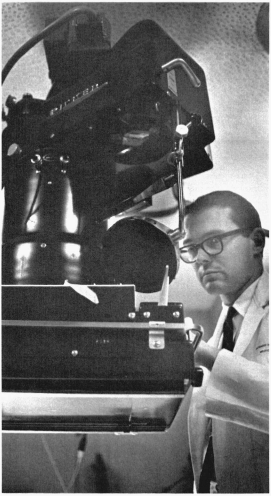
Another research team, including members from Engineering and Veterinary Medicine, is approaching the replacement problem from the standpoint of a totally-implanted artificial heart.

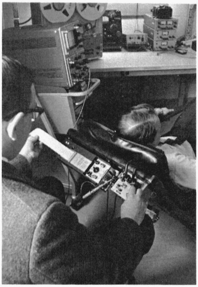
Part of the effort is directed toward the problem of converting electrical energy into mechanical energy that can operate a heart pump. Although several types of energy converters are being studied at various centers across the country, the MU group is concentrating on the use of piezoelectric ceramic discs. The application of electrical energy causes these discs to change shape slightly, and this phenomenon can be used to supply mechanical energy. The problem is to magnify the changes to the point that they can run a heart pump.

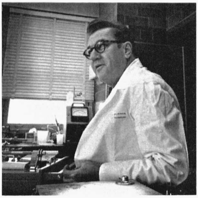
To power such a converter, Missouri researchers have developed a unique method for transmitting energy across the closed chest. Outside the body a radio transmitter and coil send electric energy to a similar coil within the chest, whereupon the converter would change it into mechanical energy. Experimental work with animals has demonstrated that the transport efficiencies of the system are more than 95 per cent at power levels greater than 50 watts. Other studies with dogs and mice indicate that body tissue is not damaged by the exposure to a 50-watt electrical field. Missouri's radio transmitter technique has been used successfully in powering pacemakers, the electronic devices attached to the sluggish heart to speed up the beat. Six such operations have been performed at the Medical Center utilizing the no-wires, outside-the-body transmitter. The conventional pacemaker has its power source inside the body. This is fine until the batteries run down, and surgical replacement becomes necessary. In the Missouri system, the patient can change the batteries himself.

Two open-heart procedures are scheduled at the Medical Center each week. Sometimes prosthetic valves are installed to replace worn-out heart valves. (Incidentally, considerable bioengineering studies of animal heart valves have been made on the Columbia campus to develop methods for preparing, sterilizing, and preserving biological aortic valves. Some surgeons believe that the use of natural valves instead of artificial ones reduces the risk of blood clotting and infection.) Other heart surgery









**Dr. John Schuder, left, holds piezoelectric energy converter, a possible method for obtaining the mechanical energy needed for an artificial heart. Center, Dr. Richard Martin checks for valve calcium as he views heart through a fluoroscope with image intensifier. Top right, chair developed through Regional Medical program takes electrocardiograms quickly and easily without usual office procedures. Bottom right, Dr. James O. Davis heads physiology team researching metabolism and heart disease.**

at Missouri involves the implanting of an existing artery from elsewhere in the body directly into the heart muscle. This also has the effect of increasing the heart's blood supply.

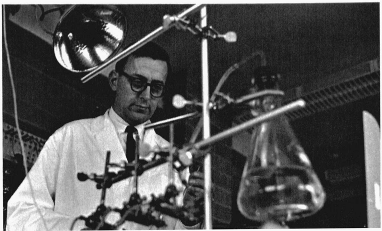
A surgical technique still in the research stage makes use of a ventricular assistor, a device placed around the heart after a heart attack to help the organ maintain normal pulsations for periods up to six hours. In experiments with the pig in which a coronary artery has been tied off and the ventricular assistor installed, researchers have found that collateral circulatory channels opened up when a normal pulse was sustained.

On the physiology front, research at the Medical Center is proceeding in four separate programs, all of them designed to understand more fully the physiological changes that occur in patients with heart disease.

One study is investigating the changes which occur after the heart muscle is deprived of its normal blood supply, a condition preceding an observable heart attack. Other research studies the changes in cardiac output and in salt and water metabolism when the heart is cut off

**Although never routine, heart surgery is commonplace at the Medical Center. Two open-heart procedures occur each week.**

Dramatic advances in human surgical techniques are closely tied to the laboratory researcher. Dr. Douglas J. Griggs Jr., right, has received a five-year renewal of a research career development award from the U.S. Public Health Service for research on ischemic heart disease. Such stipends are given in limited numbers to outstanding scientists.



from its nerve supply. This needs to be understood before the full effect of human heart transplantation can be determined. To add to the understanding of how the heart muscle works, research is being conducted on the changes resulting from variations of glycogen volumes in the heart muscle. But probably the most extensive research in physiology is concerned with the mechanisms of the kidney which control the excretion of salt and water. Abnormal mechanisms lead to water-logging of the tissues and to high blood pressure and heart disease. While these physiological studies seem technical to the layman, to the physician they have nation-wide and even world-wide importance.

In medicine, the center has tested several drugs designed to lower the blood fat levels in patients who have hardening of the arteries. This investigation is continuing as Missouri researchers are convinced that such drugs will find an important place in modern medical therapy. Millions of individuals are afflicted with high concentrations of blood fat, a condition often difficult to correct except by drugs.

One of the major efforts at the Medical Center has to do with screening techniques to find the persons prone to heart attacks. These are the individuals who are in good health now, but who have indications of possible heart problems in years to come.

New equipment also is important in heart research and treatment. The Medical Center recently acquired a sophisticated device to perform coronary arteriograms. This complicated x-ray study enables the doctor to visualize the small arteries that supply the heart muscle.

Physicians in the Missouri Regional Medical Program generally also have faculty appointments in the School of Medicine at Columbia. And the Regional Medical Program also has several projects related to heart research.

In the automated electrocardiogram project, tape recordings of heart signals are sent by doctors from several Missouri communities to the computer center at the Medical School via telephonic transmission. The computer compares the incoming signals with those already stored in its "memory," interprets the new one by these standards, and sends out results by teletype to the doctor in his office 100 or 200 miles away — all in a matter of minutes.

Another result of the Regional Medical Program's efforts has been the development of a chair which quickly and conveniently produces electrocardiograms. Electric sensors have been installed in a regular reclining chair. When a person sits down and relaxes, the sensors measure the heart's rhythm. The chair eliminates the need for removing clothing and cuts the time for the recording from the 20 minutes usually required to less than five. The chair someday should prove especially valuable in mass-screening programs.

Equipment is not a major concern of the Ecology Field and Training Station. But its research involves the heart, and its chief also is a Medical School professor.

One of its investigations is concerned with the geographic variations in death rates from cardiovascular disease. The East Coast death rate is high; the Great Plains area, low. If the rates for the low death-rate areas could be applied throughout the country, the yield would be 100,000 lives under the age of 65 saved each year.

Another research area studies the effect of stress on heart disease. In a study of Columbia postmen, it was found that the highest prevalence of coronary risk factors occurs when the ambitious personality has not achieved success. There is lesser risk for individuals who strive and succeed.

Even the hardness of the water may have a bearing on heart disease. Apparently, the harder the water, the lower the death rate. Do the so-called "good" trace elements — zinc, copper, cobalt, chromium, and manganese — have a protective effect? The Nuclear Reactor on the Columbia campus has the potential for the mass screening of such trace elements.

The Ecology Field and Training Station was located in Columbia five years ago for the very reasons that heart research on this campus progresses in a variety of areas: The government knew of the excellent facilities and competence of the Schools of Medicine and Veterinary Medicine, the Colleges of Agriculture and Engineering, and other disciplines. And it is such an interdisciplinary alliance that may one day defeat heart disease. □