

Heart attack: The biochemical insults

Coronary heart disease is characterized by these events: An artery or arteries bringing blood to the heart close down. Oxygen and sugar in the blood cannot get through to the heart, creating a state called "ischemia." If this deprivation lasts long enough, heart muscle is permanently damaged—a heart attack takes place. If a person experiences a severe enough heart attack or enough heart attacks, his heart stops functioning, and he dies.

Defining the biochemical responses of heart tissue to deprivation of oxygen and sugar has enormous clinical importance. If the sequence of biochemical events leading to the death of heart muscle could be defined, it might be possible to salvage damaged cells and to stimulate repair of them. But investigators have had trouble unmasking such events in intact animals, perfused hearts or strips of heart muscle.

Now an ideal model for studying the effects of oxygen and sugar deprivation has been found by Joanne S. Ingwall, Marlene DeLuca and Harley D. Sybers of the University of California at San Diego, and by Kern Wildenthal of the University of Texas Health Science Center at Dallas. It is the fetal mouse heart. They report their findings in the latest (July) PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES. "This model," they claim, "permits assessment of interventions designed to stimulate repair processes and to salvage damaged cells."

Ingwall and her team thought that the fetal heart might make an ideal model for studying the effects of oxygen and sugar deprivation because it can be kept beating in culture for weeks and it responds to drugs and hormones just as the adult heart does. So they obtained fetal mouse hearts and attempted to determine the effects of oxygen and sugar deprivation on the cellular process of glycolysis, whereby sugars are broken down, and on the cellular process of oxidative phosphorylation, whereby sugar in the presence of oxygen is converted into energy molecules known as ATP. ATP molecules are needed by all tissues of the body, but the energy requirement of the human heart is the greatest of any body tissue.

Three to four hours of glucose deprivation in the presence of oxygen did not affect the content of ATP in the hearts, they found. However, deprivation of oxygen in the presence of glucose for four hours resulted in immediate loss of beating function and in a significant reduction in ATP levels. During sugar and oxygen deprivation or during oxygen deprivation alone, stored sugar was also decreased.

These and other results, they conclude, show that fetal mouse hearts in culture are responsive to oxygen deprivation alone and to oxygen and glucose deprivation together, and that the hearts can be used as models to assess the value of efforts

to salvage the heart from damage from such deprivation. They have found, for example, that if they give sugar and insulin to some hearts deprived of oxygen and only sugar to other hearts deprived of oxygen, all the hearts regained the same levels of ATP (67 percent of normal). So sugar, they conclude, is clearly more important than insulin in helping the heart combat ischemia. However, glucose does not appear to be as crucial as oxygen. Continued glucose deprivation does not prevent resynthesis of ATP if oxygen is restored to the cultures.

Such findings, Ingwall told SCIENCE NEWS, provide biochemical support for the kind of therapeutic intervention many cardiologists now use on heart attack patients—drugs that minimize the heart's oxygen requirement so that damaged heart cells, which can operate only under low levels of oxygen, are not taxed. "We are currently testing a series of hormones and drugs on our models to see to what extent repair is possible," she says. □

A test to diagnose schistosomiasis



Phillips with disease detection plate.

Schistosomiasis, one of the most debilitating and widespread of the world's tropical diseases, afflicts more than 100 million people in Latin America, Africa and Asia (SN: 2/9/74, p. 88; 1/18/75, p. 44). Until now, methods of detecting the disease, including conventional blood tests, have been unreliable, because it is often mistaken for other worm diseases.

Now a team of researchers at the London School of Hygiene and Tropical Medicine has devised a simple, accurate blood test to diagnose schistosomiasis. The test involves making a highly purified solution of a protein antigen found in the schistosome, but not in other parasitic

worms. The antigen is put on an agar plate. Then the blood of a person suspected of having schistosomiasis is mixed with the antigen. If antibodies in the blood react with the antigen, the person is infected. Thousands of tests have already verified the method.

The team, led by T. Phillips, has been experimenting with an automated technique for performing these tests in field stations as well as at base laboratories. They hope that it will be widely used in the field within a year. □

Glacier-top lake: Vanishes again

Lake Linda, a water-filled depression atop Lemon Glacier near Juneau, Alaska, is in fact more like a large pond, about the size of a football field, with a typical depth of about 40 feet. It is distinguished, however, by one unusual trait: It keeps disappearing. Poof (or slurp)—one day it's there and the next it's drained dry. The lake did its trick in 1969 and again in 1970. Then just last month, it did it again.

With virtually no warning, the level of the lake simply began to drop. A depth gauge emplaced by researchers studying the lake and its glacier showed that the surface was falling by more than a centimeter per hour. For three days the strange recession continued, representing a substantial water loss, although nothing approaching total banishment. Then, on the morning of the fourth day, the observers returned to check their gauge. The gauge wasn't necessary: Overnight, Lake Linda had run dry.

Strange as they are, the vanishing waters are not unique to Lake Linda. The same phenomenon, says James E. Bugh of the State University of New York at Cortland, is known in British Columbia, Iceland, coastal Greenland, coastal Scandinavia and even such far-removed regions as New Zealand and the Andes Mountains of South America. The cause of the sudden drainage, however, is not always the same.

Lake Linda's disappearing act is triggered when the accumulating weight of its water—there were 13 inches of rain in July, says Bugh—becomes great enough to reopen fissures and caves in the glacier beneath. The contents of the lake run out through the cracks, finally exiting, most of it in a single stream, through openings lower down on the sides of the glacier.

But Linda is just a little lake. In Iceland, Bugh says, much larger, deeper lakes sometimes drain abruptly by building up enough water pressure to literally lift the glaciers that enclose them, sometimes resulting in "a wall of water 50 to 100 feet high" rushing forth from beneath the icy skirts. Nor does the resettling of



Smithsonian Center for Short-Lived Phenomena

Route of Lake Linda's vanishing waters.

the glacier after the initial drainage always shut off the flow. Sometimes the glacier will fracture from having been picked up, says Bugh, letting the entire body of water recede away to nothing.

On such a scale, in fact, even community planners have to take the potential danger into account. So great are the surges, called Jökulhlaups, from the draining Icelandic lakes that valleys have been scoured clean by the rushing waters.

Lake Linda poses no such problem—yet. But in the last two years, says Bugh, about 20 homes have been built in Mt. Lemon valley, a sort of mini-suburb of Juneau, at the end of the valley away from the glacier. If the rapid growth of the Juneau area continues to spread civilization up the valley, he says, “it will become increasingly vital to understand and predict this phenomenon.”

Researchers on Lemon Glacier, largely sponsored by the Foundation for Glacier and Environmental Research, based in Juneau, are now studying the lake's hydrologic mass balance, comparing the input from rain and snow with losses due to evaporation, drainage (the less-than-catastrophic variety) and other sources. In addition, because the lake itself is visible in satellite photos taken by Landsat, the investigators want to find out whether the amount of water in the lake can also be monitored from orbit.

Yet, says Bugh, despite the weirdness of the disappearing lake, there is a more fundamental question: How does a basin big enough to hold a lake form on top of a glacier in the first place? □

Rand grants Ph.D.'s

The Rand Corp.—the California-based think tank—has just become the first private research company in the world accredited to grant doctoral degrees. The Rand Ph.D. is only in one field, policy analysis, with three degrees granted so far. The academic advisory board has four Nobel laureates, and research topics will be based on the corporation's current projects. □

Academy's private status is upheld

A long-simmering issue that bubbles to the boiling point periodically in Washington is whether the National Academy of Sciences can, for legal purposes, be considered an agency of the Federal Government. Academy officials have long contended the answer is no. Certain critics, anxious to get at the records of Academy committee deliberations on controversial technological issues, have maintained that the answer is yes. If the Academy were judged to be a Federal agency, it would be forced to comply with the open-meeting and open-records provisions of the Federal Advisory Committee Act and the Freedom of Information Act.

A recent court decision has now resolved the matter. U.S. District Judge John J. Sirica has ruled that the Academy is not a Government agency under any of the definitions used by the two Acts. The decision gets the Academy off the legal hook on the whole issue, and allows it to decide its own policies on openness of its advisory committee deliberations. Academy President Philip Handler has gradually been implementing a more open policy (SN: 5/17/75, p. 317), but some critics feel it does not go far enough in meeting needs of public accessibility (SN: 6/21/75, p. 406). The Academy's voluntary new policy provides for making available, upon request, minutes of committee meetings, subcommittee reports and copies of all external information and documents considered in a study, but only after the full report is published.

In his 21-page decision (Civil Action 74-431, July 28), Sirica said the fact that the Academy receives a great deal of Federal money through Government contracts (three-fourths of its total revenue) and that Congress and the executive branch solicit its advice does not indicate that the Academy has “agency” status. “What the plaintiffs have not shown, and what the Court fails to perceive, is any significant delegation of governmental authority, jurisdiction, administrative function or power. The Academy may be an ally of the Government, but it is not an ‘authority of the Government of the United States.’ Thus, the plaintiffs’ major contention, that the Academy is an ‘agency’ for purposes of the Federal Advisory Committee Act, must be rejected.”

Similarly rejected was the contention that the Academy is an “agency” under the 1974 Amendments to the Freedom of Information Act. Sirica based his decision on a review of the legislative history which convinced him the Act was not intended to apply directly to private entities that merely contract with the Government to conduct studies. He found that the Academy was not an “establishment in the executive branch of the government,” not a “Government corporation,” not a “wholly Government-owned enter-

prise,” not a “Government controlled corporation,” not an “authority of the Government” and not a performer of “Governmental functions”—all definitions of “agency” under the FOI Act.

The decision also rejected claims that the Academy's Committee on Motor Vehicle Emissions is an “advisory committee established by and utilized by” the Environmental Protection Agency. Sirica said it was clear that Congress intended to exclude from the coverage of the Federal Advisory Committee Act groups providing advice to Federal agencies under contract, and specifically committees of the Academy.

The suit was brought by the Public Interest Campaign, a nonprofit educational and charitable association with a special interest in air pollution, and its president, Louis Lombardo. They contended that the closed-door deliberations of the Academy's Committee on Motor Vehicle Emissions were being conducted in violation of the law. The plaintiffs appealed the Sirica decision to the U.S. Court of Appeals on Aug. 20. □

‘New monkey law’ struck down

Just over 50 years after a Dayton, Tenn., high school biology teacher, John Scopes, was fined \$100 for teaching evolution in violation of state law, the latest legal barrier to public school acceptance of the theory was struck down. A Federal judge and the Tennessee Supreme Court last week declared unconstitutional a 1973 law requiring biology textbooks to provide equal space to Biblical and scientific theories.

In a stinging rebuke, U.S. District Judge Frank Gray Jr. ruled, “Every religious sect, from the worshipers of Apollo to the followers of Zoroaster, has its belief or theory. It is beyond the comprehension of this court how the legislature, if indeed it did, expected that all such theories could be included in any textbook of reasonable size.” To provide equal space to religious theories in public school texts would violate First Amendment guarantees of separation of church and state, Judge Gray decided.

Earlier, the Tennessee Supreme Court had affirmed a ruling by a county official that the “New Monkey Law” violated both state and Federal constitutions. One district Federal court had failed to act on the case, but a Court of Appeals ruled such abstention was inappropriate.

(Scopes' conviction in the famous 1925 trial was eventually overturned because the fine had been set too high, but the original “Monkey Law” remained on the books for many years.) □