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Automated lipoprotein scan can cut heart disease deaths

The death rate from heart attacks and strokes could be drastically cut, many medical researchers believe, if blood plasma were routinely analyzed for the amount of fats and the 'type' of lipoprotein pattern present.

But large scale screening to reveal disorders of fat metabolism has not been practical because the procedures required many hours of exacting hand work and tedious calculations by one or more highly skilled technicians.

This month, however, biophysicist Frank Lindgren of LBL's Donner Laboratory unveiled an extremely complete system to accurately and automatically analyze minute plasma lipoprotein concentrations and perform the necessary computations in a fraction of the time of the old method. In fact, samples from 30 patients can be processed in only 20 minutes.

Dr. Lindgren, who helped pioneer the study of lipoprotein disorders and coronary heart disease at Donner Lab in the early 1950's, has been working on the computerized prototype analytical system for almost two years. The first clinical applications are already in progress at Merritt Hospital in Oakland in collaboration with internist Dr. Ronald Krauss.

Cholesterol, the substance most often blamed for coronary heart disease, is actually only one of the plasma fats (lipids) involved; the other is triglyceride. These lipids do not circulate freely in the blood, but are bound together in various combinations with proteins and other lipids to make large complex molecules called lipoproteins.

Within the past ten years lipoprotein typing has been well-researched, and there are now five recognized types of abnormal lipoprotein patterns. Since each type requires different dietary and/or medical treatment for effective therapy, it is necessary to correctly identify which lipoproteins are elevated and by how much. It is not enough simply to say a patient has too much cholesterol and/or triglyceride in his blood.

What makes lipoprotein analysis so complex is that these large molecules are difficult to separate from one another. But they can be grouped in four classes, according to their

(Continued on page 6)

Demonstrating the new computerized lipoprotein scanning system to improve heart disease diagnosis are biophysicist Frank Lindgren (center), research technician Jerry Adamson (rear) and electrical engineer Paul Banchero. Lipoprotein concentrations in blood plasma samples are measured in the scanning device (background), and the information is fed into the PDP-8 computer.

Cosmic background radiation is as old as the universe

The origin of the universe as a 'primordial fireball' which exploded perhaps ten billion years ago is a fascinating theory that is beginning to look more like fact, since scientists have searched for and found some 'fossil' cosmic radiation left over from the early universe.

But until recently no one had succeeded in measuring the spectrum of this 'fossil' radiation in the infrared wavelength range to see if its energy curve had the shape predicted for radiation of cosmic origin.

At the American Physical Society meeting in Washington, D.C., in late April, Dr. Paul Richards, a physicist in LBL's Inorganic Materials Research Division and a professor of physics on campus, announced that he and graduate students David Woody, John Mather and Norman Nishioka had successfully measured this 'cosmic background' in the infrared range.

Richards' experiment is significant because of the strong support it gives to

(Continued on back page)

LBL first: accelerating two different beams at once

Adam and Eve, the SuperHILAC's two heavy ion injectors once so aloof from each other, were coupled this month in a ceremony performed by computers. The result is that the SuperHILAC can and is now pulsing beams of two different ions almost simultaneously, with each injector contributing ions on alternating pulses. In fact, under discussion is the addition of a third injector, bringing the total number of possible 'simultaneous' beams to at least three.

Officiating at the union were Hermann Grunder, leader of the Bevalac project, Frank Selph, in charge of the SuperHILAC effort to achieve computer control, Vic Elischer, programming chief for the Bevalac's new computer system, and the indefatigable staff headed by Bob Force at the Bevatron and Ross Nemetz at the SuperHILAC.

Since the SuperHILAC pulses very rapidly, up to 36 times per second, the alternating of all accelerator settings to provide experiments with one of two different

second can only be performed by computer. At the same time, one pulse per second of one of the beams can be sent to the Bevatron through the Bevalac transfer line. The Bevatron can accept particles once every six seconds, so SuperHILAC users don't even miss the one percent of beam diverted to their associates down the hill. Simultaneous production of different beams and time-sharing among accelerators and experimenters have not been accomplished anywhere else in the world.

This mode of operation is in sharp contrast to the first six months of the Bevalac's existence. When the Bevalac was inaugurated last August as an association of the SuperHILAC and the Bevatron, beams from the former had to be brought downhill to the Bevatron by manual control of all accelerating and steering elements. While this was happening, the SuperHILAC's own experimental programs were interrupted. Now, however, the two machines can

LBL offers technological help to city, county governments

In many respects, the age of high technology seems to have bypassed city and county governments. Yet the activities of local governmental units have a substantial impact on our lives, a situation which takes on an ironic aspect for LBL staff members engaged in research at the frontiers of science and technology.

One reason for local governments' non-use of technological advancements is that their main source of information and equipment in these areas comes from companies with products to sell. Unfortunately, many firms consider local governments to be poor potential customers and are reluctant to develop new products for them.

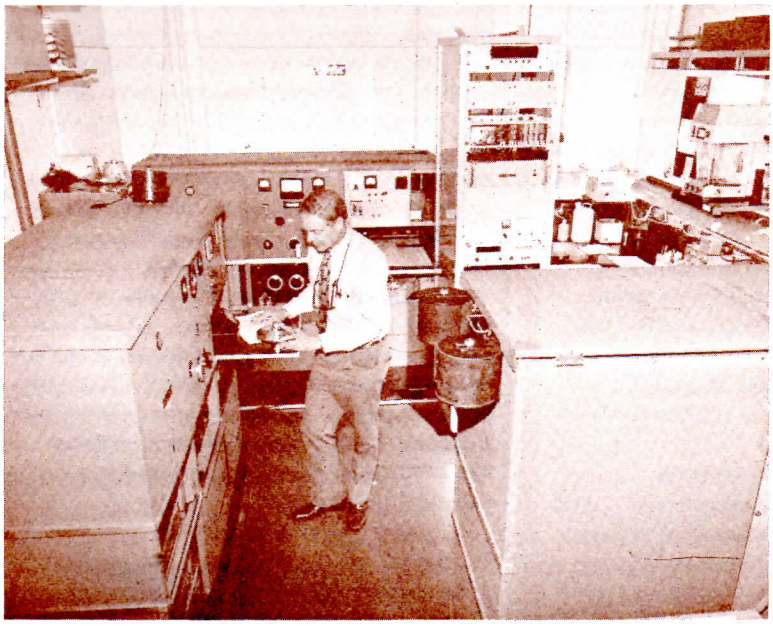
LBL would like to eliminate the technological vacuum surrounding city and regional governments. Along with other ERDA laboratories participating with the ERDA office of Industry and State and Local Government Relations, LBL is trying to let local governing units in on new developments and ideas that may be useful to them.

At LBL this effort is coordinated by the Technology Utilization Office, headed by Bob Morris, a patent engineer for 21 years at the Laboratory. Morris and some of his counterparts at six other federally-funded laboratories in California (four Navy labs, one NASA lab and two ERDA labs) have started holding joint meetings with the operating staffs of several California cities. These meetings provide an opportunity for the laboratory representatives to briefly describe the technical activities at each institution, and for city personnel to discuss their specific technological problems. Then an attempt is made to find solutions to the problems or refer each city official to knowledgeable sources of information.

City officials have expressed a desire for modern help in the areas of crime prevention and detection, innovations in fire fighting and prevention methods, noise abatement, waste disposal, energy conservation, building inspection, management methods, and street maintenance to name a few. A list of specific needs has been developed which ranges from more effective ways of locating and repairing cracks, holes or other defects in underground pipes to less expensive systems for checking out library books.

Perhaps you know of some technological device, method, idea, or knowledge developed and used at LBL that could be adapted for local governments. If so, you can funnel the information to Bob Morris. For example, several cities have been extremely interested in such items as the census data stored in LBL computers and the Lab publication "Instrumentation for Environmental Monitoring."

Got any other ideas?



Frank Lindgren in Donner Lab's ultracentrifuge facility. Without the new streamlined scanning method, a roomful of expensive equipment like this is required to analyze plasma lipoproteins.

Automated lipoprotein scanning...

(Continued from page 1)

size and density, from very large fatty molecules with little protein content, to much smaller very dense protein-rich, lipid-poor ones. The variations in density permit separation of lipoproteins in the ultracentrifuge, where the larger, less dense groups can be separated from the smaller denser ones.

Donner Laboratory's unique analytic ultracentrifuge facility has served researchers around the world for over 25 years as one standard of lipoprotein identification and measurement. But ultracentrifugation is much too expensive, complicated and time-consuming for widespread clinical use.

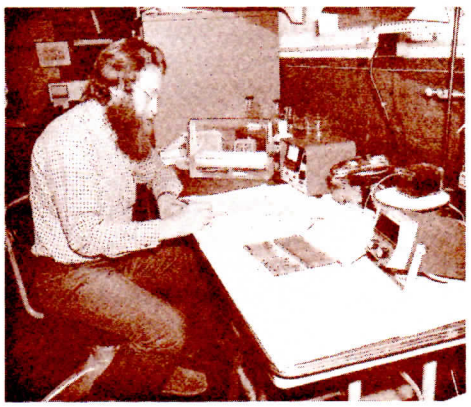
Within the last decade, the technique of electrophoresis has also been increasingly used to qualitatively separate individual lipoproteins in a patient's blood. Electrophoresis makes use of the differences in electric charge on the various lipoproteins, so that when a small sample of plasma is placed in an electric field, each lipoprotein class migrates at a different rate in a repeatable manner. These separated lipoprotein bands are visualized with a fat stain and their concentrations measured with a densitometer.

While electrophoresis requires little equipment, and is a much simpler procedure than ultracentrifugation, it has not been nearly so reliable in delivering the clear information necessary for diagnosis and treatment.

Dr. Lindgren and his associates at LBL have been studying electrophoresis techniques, especially some of the off the shelf analytical kits put out by several commercial companies. They have tested and calibrated several kits and have made changes to improve reliability and reproducibility, including an internal standardization procedure. The ultracentrifuge has been used to calibrate and standardize the microelectrophoresis system during its development.

Now Dr. Lindgren has combined a packaged electrophoresis kit, which when used alone is still a sensitive operation requiring a carefully trained technician, with an automatic microdensitometry scanning device and a computer system to analyze the intensity of the separated lipoprotein bands. Information from the densitometer is fed into a small PDP-8 computer for processing into the form desired by the physician, comparing the results with normal population values.

Dr. Lindgren predicts that within a year or so this system or one patterned after it, may have widespread clinical application.



Research technician Jerry Adamson made several critical improvements in the lipoprotein analysis techniques. The new system still requires a technician to prepare slides of plasma samples, but the tedious measurements and calculations are automatic.