

pancreas cells is a process of several steps. First a long protein chain is synthesized, then enzymes clip it into several pieces, two of which combine to form the final insulin molecule. From their analysis of the DNA, the researchers were able to deduce for, the first time, the amino acid sequence of several discarded parts of the precursor molecule. The investigators also determined the sequence of the DNA just beyond the insulin gene. That region of DNA does not code for any protein, but it may contain the specific signals that control when protein will be made from the gene. The researchers suggest that analyzing the DNA sequences may yield clues to some varieties of diabetes by indicating just what is amiss.

"These experiments with insulin really emphasize the benefits over the risks; they point out the possible practical application of recombinant DNA research," say Goodman and Rutter. □

More signs of a heavy lepton

One of the things enthusiasts for the new unified field theories of particle physics are looking for is evidence of the existence of so-called heavy leptons. Heavy leptons are unstable and more massive relatives of the known leptons—the electron, the muon and the two kinds of neutrino. Their existence (plus the new kinds of neutrino that ought to come along with them) will balance out the scheme of particles required by theories that attempt to unify the descriptions of all the forces that animate particle physics into a single unified theory.

Last week, *SCIENCE NEWS* reported evidence for possible heavy leptons from an experiment at Fermilab in Illinois. Almost two years ago (SN: 8/2/75, p. 68), Martin Perl of Stanford University reported evidence for a heavy lepton, which he called a U particle, having a mass around 2 billion electron-volts (2 GeV). Later he pointed out that this U might be alternatively explained as one of the newly discovered family of charmed particles. Now a report from the DORIS storage ring facility at the Deutsches Elektronen-Synchrotron at Hamburg strongly supports both the existence of the U particle and its heavy-lepton nature.

Reporting from Germany, the May 12 *NEW SCIENTIST* points out that the DORIS events occurred at a total energy of 4 GeV. This strongly suggests creation of pairs of U's (one electrically positive, one negative) that then decay into muons or electrons plus neutrinos, which go away unobserved. An important point is that the energy spectrum of the resulting electrons agrees with what theory expects from a heavy-lepton decay. The electron-energy spectrum from the decay of a charmed particle would be something quite different. □

How does vitamin E prevent aging?

Some of the more provocative aging research of recent years concerns vitamin E's ability to retard aging. Denham Harman of the University of Nebraska School of Medicine, one of the nation's leading gerontology researchers, found that vitamin E could extend the lives of rodents by some 30 percent (SN: 3/18/72, p. 188).

These results prompted investigators to ask whether vitamin E could extend human lives as well. But because aging studies in people require years, two other respected gerontology researchers, Lester Packer of the University of California at Berkeley and James R. Smith of the Veterans Administration Hospital in Martinez, Calif., undertook to see whether vitamin E could extend the lives of human lung cells in the test tube. The vitamin did appear to double the usual lifespan of these cells, compared with cultures of control human lung cells. In fact, vitamin-treated cells were still dividing when the experiment ended (SN: 9/28/74, p. 199).

But three years and 19 experiments later, Packer and Smith (who is now with the W. Alton Jones Cell Science Center in Lake Placid, N.Y.) have still not been able to reproduce the results of their first experiment. They report this failure in the April *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES*. Other investigators, they add, have also had trouble confirming their results, notably Leonard Hayflick, another veteran gerontologist at Stanford University.

Rather than conclude that their initial study was erroneous and the later ones correct, Packer and Smith contend that there might have been something special about the first experiment that made it work. What could the singular, crucial factor be? They suggest that there was probably some chemical difference between the calf serum (fluid component of blood without blood cells and clotting factors) used in the first experiment and that used in subsequent experiments. Such a suggestion is plausible. Calf serum is the nutrient medium of choice for cell culturing, and each lot of serum that biologists buy from biological and chemical companies is nonidentical.

So it is quite possible that the calf serum Packer and Smith used in their first experiment was sufficiently different from that used in subsequent experiments to produce disparate results. Another group of researchers, in fact, has found that dissimilar serum lots resulted in varying test-tube lifespans of human lung cells. They are Edward S. Schneider, Youji Mitsui and Karen Braunschweiger of the Gerontology Research Center in Baltimore (the in-house research program of the recently formed National Institute on Aging).

Assuming that Packer and Smith's suggestion is valid, it would alter the going explanation of how vitamin E retards aging. Past evidence, supplied by Harman, Packer and Smith and some other researchers, suggests that vitamin E increases the lifespan of cells by protecting them from free radicals. Free radicals are highly reactive chemicals. All cells produce them in small amounts in the course of their everyday reactions. Free radicals are also produced by many environmental chemicals. More specifically, vitamin E's effect in countering aging has appeared to be due to its antioxidant abilities—it protects cells from excess oxidation produced by free radicals. Indeed, diet supplementation with some other antioxidants besides vitamin E—Santoquin (a quinoline derivative), 2-MEA (2-mercaptoethylamine) and BHT (butylated hydroxytoluene)—can also increase the lifespan of animals.

But vitamin E does not always increase cellular lifespan while working as an antioxidant, Packer and Smith have found. So vitamin E's antioxidant properties were probably not alone responsible for the increase in cellular lifespan initially observed. However, because the lifespan of control cultures in the original lot of serum was not unusually long, serum alone could not be responsible for the increased lifespan observed among the vitamin-treated cells. Thus Packer and Smith conclude that vitamin E probably extended the lives of cells in the first experiment by interacting with some chemical or chemicals in the batch of calf serum used. In analyzing the little bit of serum they had left from their initial experiment, however, they were not able to identify any compounds that might have been responsible for the effects. □

Cancer immunization: Tempered progress

One of the more innovative approaches to cancer treatment and prevention is to exploit the body's immune system against cancer viruses in hopes that, while viruses have still not been proven causes of human cancers, the techniques might have some value for people. One of the more promising avenues in this area was reported two years ago by a team of German and American scientists—notably Werner Schäfer of the Max Planck Institute for Virus Research in Tübingen, West Germany, Dani P. Bolognesi of the Duke University Medical Center and Fernando de Noronha of Cornell University.

For the first time, viral-induced leukemia was successfully prevented in mammals (mice) by using purified viral antigen as a vaccine and was cured in mammals (mice) by using antiserum to this purified

antigen. Because the same class of tumor viruses was implicated in human as well as in animal leukemia, the researchers hoped that the antigen and antiserum might eventually be used to vaccinate and treat people against leukemia (SN: 10/25/75, p. 261).

Since then, this hope has been tempered by two disappointments. One, the investigators have found that they could never harvest enough of the antigen for large-scale clinical vaccination purposes. For another, they are reluctant to try the antiserum on leukemia patients until an antigen cross-reactive with the mouse leukemia virus antigen has been found in such patients. Otherwise, the antiserum might enhance rather than suppress the cancer process. Although a number of scientists have been probing for such a cross-reactive antigen, it has still not been found.

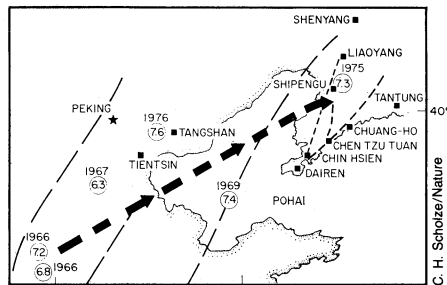
However, leukemia antiserum may yet help leukemia patients and possibly even patients with solid tumors known as sarcomas. Meanwhile, more valuable insights are emerging about viral-caused cancers and how to cope with them.

In a recent set of experiments conducted by Schäfer, Bolognesi, de Noronha and Raymond Baggs of Cornell University, soon to be published, the mouse leukemia antiserum has been found to block leukemia virus infection in cats once it gets started. It may also actually cure (permanently suppress) leukemia in cats—those results are not yet available because feline viral leukemia develops slowly. These findings further suggest that the mouse antiserum is cross-species effective and that if it successfully treats leukemia in cats, it might be able to do so in humans as well. Of course, if an antigen cross-reactive with the mouse leukemia antigen is ever discovered in leukemia patients, antiserum could probably be made just as easily against it for treatment purposes.

The other experiments conducted by Schäfer, Bolognesi, de Noronha and Baggs, just reported in the May 5 NATURE, show that leukemia antiserum can successfully fight not only leukemia but also sarcomas. They injected cat sarcoma virus into 24 kittens. Eleven of the kittens did not receive any viral antiserum; all died. Eight got feline leukemia viral antiserum right after they were infected; none developed cancer. Five of the infected kittens were given mouse leukemia antiserum; three got cancer, two survived.

"It is certainly remarkable," the researchers conclude, "that by simple application of antibody, it is possible to achieve such a striking effect on a solid tumor without any obvious detriment to the host." Also interesting is the modest but nonetheless real effect of mouse antiserum in another species—the cat—in fighting sarcomas. Whether leukemia antiserum, mouse, cat or otherwise, might be able to help human sarcoma victims, of course, is even more on the horizon than its value for leukemia patients. □

Did a moving ripple cause China quake?



Path of the proposed deformation front.

The successfully predicted 1975 Haicheng earthquake in China may have been triggered by a deformation front that propagated 1,000 kilometers through northeastern China at a velocity of about 110 kilometers a year. This proposed deformation front could explain the various phenomena that were used to predict the quake, suggests geophysicist Christopher H. Scholz of the Lamont-Doherty Geological Observatory in the May 12 NATURE.

The magnitude 7.3 event was the first major earthquake to have been successfully predicted. The prediction is considered to have saved thousands of lives, and there has been intense geophysical interest in China earthquake prediction and particularly the events that have ever since surrounded the Haicheng quake.

The Chinese used observations of a variety of different phenomena to make their prediction. Scholz's proposed deformation front supplies a physical interpretation connecting the phenomena used to make the prediction and the occurrence of the earthquake.

Among the most interesting of the phenomena was the observed northeasterly migration of a series of large earthquakes beginning with two in 1966 and culminating with a magnitude 7.4 event in the Pohai Gulf in 1969. That this migration to the northeast occurred is beyond doubt. What is important, says Scholz, is whether there is some causative process responsible for the migration that helped lead to the ability to predict the Haicheng quake. He believes there is—a migrating source of stress of presumably deep-seated origin. If one assumes a deformation front propagated through China along a northeasterly path at 110 kilometers a year (see map) all sorts of observed events used in the prediction can be explained. Among these are the migration of major earthquakes, the increased seismicity in Liaoning Province in 1973, the successive onset of three tilt anomalies at Chin Hsien, Shipengu and Shenyang, the triggering of a swarm of quakes at Liaoyang in mid-December 1974, and then the Haicheng quake.

Scholz calls his deformation front proposal "a plausible hypothesis" for connecting these diverse phenomena, the success of the prediction being the strongest argument for this plausibility. In venturing this hypothesis, "I have proposed the existence of a previously unknown phenomenon, the underlying mechanism of which is not understood."

He suggests that migrations of large earthquakes, commonly at velocities between 80 and 270 kilometers a year, may be caused by propagating deformation fronts. "If this phenomenon is common, it may prove a powerful tool for earthquake prediction." □

Free-flying birds and geomagnetism

Do birds use the earth's magnetic field in navigation? Most of the evidence that birds extract directional information from the geomagnetic field comes primarily from controlled cage experiments and from homing experiments with pigeons.

Now a Clemson University zoologist, Frank R. Moore, reports what he says is, "to my knowledge, the first direct visual evidence that the orientation of free-flying nocturnal migrants is affected by natural fluctuations in the geomagnetic field."

The direct visual observations of migrating birds aloft were carried out by S. A. Gauthreaux Jr. over a six-year period during the spring and fall months in the southeastern United States. The main technique was to record the movement and number of migrants passing through vertically directed beams of light. This information is then compared with data on fluctuations of earth's magnetic field.

Moore finds that in both the spring and fall, the accuracy of migratory birds' orientations deteriorated with increasing disturbance to the earth's magnetic field. The more intense the geomagnetic disturbance, the greater the spread or variation in the birds' paths.

In the spring, the vertical component of the magnetic field was found to be the important variable. In the fall, the horizontal component was the important variable. Fluctuations in the declination of the magnetic field seemed to have no effect regardless of season.

"The evidence lends additional credence to the view that birds respond to magnetic stimuli and suggests that the orientation of free-flying migrants is influenced by fluctuations in the geomagnetic field," Moore concludes in the May 6 SCIENCE. But whether the magnetic disturbances act directly or indirectly on the birds' orientation system—through some other, unidentified, intervening variable perhaps—is not clear. Nevertheless, says Moore, "a strong correlation between the orientation of free-flying birds and geomagnetism has been demonstrated." □