Biomedicine

Predicting childhood diabetes

A child with antibodies against insulin-manufacturing cells, low levels of insulin production and who shares certain genes with a sibling who has insulin-dependent diabetes is likely to develop the disease, according to a study by Fredda Ginsberg-Fellner and colleagues that appears in the Sept. 20 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION (JAMA).

The findings, made at the Mount Sinai School of Medicine in New York and the National Institutes of Health in Bethesda, Md., are similar to results published in the Aug. 22 NEW ENGLAND JOURNAL OF MEDICINE by researchers from the Joslin Diabetes Center in Boston. The Joslin study showed that even without checking for the genetic similarity, the antibody and insulin measurements can be used to predict subsequent diabetes.

The JAMA study followed, for an average of 4½ years, 351 nondiabetic siblings in 178 families with one or more juvenile diabetics. Of the ten siblings who became diabetic, eight shared a specific set of genes linked to diabetes, and months to years before clinical diabetes appeared all had lower-than-normal levels of insulin secretion as well as antibodies to insulin producing cells.

By alerting people at risk, it lessens the chances of the new diabetic going into diabetic shock before the disease is recognized, says Sri Srikanta, one of the Joslin researchers. More importantly, he says, studying the disease before clinical signs appear will help to identify the mechanism of diabetes and will also identify likely participants in experiments to identify factors that may prevent the disease.

The immediate clinical value of knowing who is at high risk of getting insulin-dependent diabetes is limited, Richard A. Guthrie of the Kansas Regional Diabetes Center in Wichita says, since there are no established preventives. "The great value is in research. We can learn more about the etiology and natural history of the disease."

These and other early diagnosis studies have already shown that the disease is not a sudden occurrence, as had been thought (SN: 2/19/83, p. 117). "The clock for the disease has been totally reset backwards," Srikanta says. "No one knew there was such a long latent period."

MS: Cooling it chemically

People with multiple sclerosis tend to suffer fewer symptoms of the nerve-degenerating disease in cold weather. Patients who can walk often lose that ability when they have a fever. To exploit this temperature dependence, Floyd Davis and colleagues at Rush Medical College in Chicago have been working with 4-aminopyridine, a chemical that mimics the effect of cold on nerves. The drug looks promising but much more work needs to be done before it can be considered for use, Davis says.

Cold slows down the nerve impulse, which is electrically conducted, resulting in an increased current. That can power the impulse through the degenerated part of the nerve, Davis says. The drug slows down the nerve impulse by blocking the flow of potassium ions, which conduct the current.

In a study of 12 patients with particularly heat-sensitive MS, being presented this month in Chicago at the American Neurological Association meeting, Davis and his colleagues found that seven of the 12 had a significant improvement in vision, and five showed a greater use of their arms and legs. At the moment, 4-aminopyridine has to be administered intravenously, and its effects wear off within a few hours.

"It offers hope for a way of treating the disease, but it won't reverse the process," Davis notes.

Byron Waksman, director of research for the National Multiple Sclerosis Society, which funded the work, says, "It's not anything that can be used as a treatment, but it shows the approach has merit."

Chemistry

Similar recipes for diets and 'ivory'

Several years ago, polymer chemist Orlando A. Battista developed processes for extracting virus-sized crystals from cellulose and from synthetic polymers such as nylon and polyester (SN: 4/10/82, p. 246). Now, retired from industry and the president of his own Ft. Worth-based research institute, Battista is patenting diverse applications for insoluble gels made from these microcrystals and licensing the technologies to commercial developers. While a French company is preparing to market disposable contact lenses based on these gels, two of the newest licensed applications being pursued in the United States are a diet aid and synthetic ivory.

Ordinary fibrous cellulose contains a chain of small crystals linked by hingelike fragments. Battista developed an acid process that cleaves off the hinges without attacking the crystals. Mixed with water, the crystals gel into an insoluble, creamlike glue, which is used widely as the pharmacologically inert binder holding many dry pills or tablets together.

For the diet aid, a microcrystalline-cellulose gel is used to bind ordinary cellulose fibers to a protein gelatin, like the gelatin that serves as the basis for Jell-O. "Cross-linking" the gelatin's protein — adding a molecule that makes a covalent chemical bond between two amino acid chains — gives it sustained resistance to acid degradation in the stomach. The result is that the protein takes longer to digest.

In processing, the gelatin-cellulose material is compressed to about 5 percent of its original volume. When later consumed with a glass of water, it will swell to about 20 times its consumed volume, exerting a mechanical pressure on the walls of the stomach so that the person truly feels full.

In the hour it takes the diet aid's protein to break down in the stomach, the body will be fooled into thinking its caloric cravings have been sated, Battista says. Yet a 3-gram diet bar need not contain more than 2 or 3 calories. A small pill of the material, taken shortly before the meals, would allow diners to feel satisfied with smaller portions. In addition, Battista notes, these weight-control aids supply fiber to the diet.

"A cellulose-based pill is not a new idea" for dieting, says Christopher Smith in the Food and Drug Administration's (FDA's) Rockville, Md., office. FDA believes "the idea has merit," he told SCIENCE NEWS. The real question is whether it's safe and effective in helping people curb their appetites. And there will be no way of judging that, he says, until formal research studies on the product are submitted to FDA for review.

Preliminary clinical work has already been done, Battista told reporters at the recent American Chemical Society meeting in Chicago, although further clinical trials must still be conducted by the commercial developer before the product can win Food and Drug Administration approval. However, because the product contains only ingredients that FDA has already listed as "generally recognized as safe," Battista anticipates approval will not be difficult.

A similar recipe is used to concoct synthetic ivory. A different cross-linked gelatin (whose formulation is proprietary) is mixed with microcrystalline cellulose and calcium phosphate. Allowed to dry at room temperature for 10 weeks, the resulting material "has essentially the same chemical composition as elephant tusk," Battista says, and is virtually indistinguishable from real ivory.

Eliminating the calcium phosphate from the recipe and heating the material to 850°C in a nitrogen environment creates a one-third-sized carbon version of the original that preserves all structural details of the prefiring piece — including any lathe marks or molecular pore configurations. Heating to 2,000°C converts the prefiring piece to graphite. Not only are these carbon and graphite materials more durable than those produced by the simple compression of petroleum pitch, Battista says, but they also make it easier to engineer larger and smaller structures.