Cloning the genes for A and B blood types

Amid the fast-breaking findings in molecular biology, the identification of a couple more human genes may seem almost commonplace. But this time researchers have gone against type, cloning the genes that determine two major blood groups, A and B. Moreover, by inserting the cloned genes into type O blood cells – which have no major blood-type markers, or antigens, of their own – the scientists then induced these cells to produce the A and B antigens on their surfaces.

The new findings may eventually offer a method for altering the blood type of individuals, and may someday help blood bank technicians direct stored precursor blood cells to differentiate into a specific blood cell type. More immediately, the work may provide a tool for examining in unprecedented detail the parental contributions to each person's blood type, enabling forensic experts, for example, to more closely tie a suspect to the scene of a crime. In addition, says Sen-itiroh Hakomori of the the University of Washington in Seattle and the affiliated Biomembrane Institute, the findings suggest a new technique for combating certain cancers.

Hakomori and his colleagues analyzed the genes associated with the A and B antigens in blood cell lines belonging to the three major blood groups, A, B and O. The team reports in the May 17 NATURE that A and B genes differ by only four nucleotides – the building blocks of DNA and RNA – suggesting they may have been identical until several million years ago. The researchers also solved a long-standing mystery about the O gene, discovering that the gene's inability to produce antigen stems from the lack of a single nucleotide present in the A and B genes. The missing nucleotide causes the O gene to make a protein incapable of marking the cell with an A or B antigen, Hakomori notes.

The team's success in coaxing O blood cells to produce A and B antigens indicates the potential for one day altering a person's blood type, but that possibility "may be down the pike," says hematologist Elizabeth Read of the National Heart, Lung and Blood Institute in Bethesda, Md.

Other applications may prove easier to develop, Hakomori agrees. For example, he notes, epithelial cells normally express the same A, B or O antigens present on blood cells. But in some type O patients with epithelial cell cancers, these cells spontaneously express A or B antigens – substances that are foreign to the bodies of these individuals and that can trigger an immune response against the cancer cells. Genetic manipulation to selectively enhance the ability of cancer cells to produce these foreign antigens, he says, may stimulate the immune system to eradicate epithelial cancers.

Techniques for accomplishing this goal are not yet available. But a diagnostic procedure using the cloned genes could aid certain cancer patients in the near future, says immunologist Kenneth O. Lloyd of the Memorial Sloan-Kettering Cancer Center in New York City. Compared to currently available assays, such a gene test could more easily identify those patients whose cancers produce foreign blood-type antigens. Physicians might then boost levels of the appropriate antibodies to battle patients' cancer cells, he adds.

Read notes that the gene cloning may pave the way for identification of other blood-group antigens present on cancer cells, expanding the potential for treatment. Hakomori told SCIENCE NEWS that he and his co-workers are now attempting to clone the gene that codes for a minor blood antigen, called H-Lewis, present on some blood and epithelial cells.

– R. Cowen

Noble tries win Nobel trip

A successful attempt to apply some of the flight characteristics of the dragonfly to aircraft design, and a computer-assisted investigation of a mathematical system called p-adic numbers, proved best of show at the 41st International Science and Engineering Fair in Tulsa, Okla., last week, earning two high school seniors all-expense-paid trips to Stockholm, Sweden, to attend the Nobel Prize presentations this December.

Judges awarded the Glenn T. Seaborg Nobel Prize Visit Awards to Alexander Jacques Fleming, 18, of Glynn Academy High School in Brunswick, Ga., and Joshua B. Fischman, 17, of Montgomery Blair High School in Silver Spring, Md. Fleming won for "Mimicking the Flight Capabilities of the Dragonfly in an Aircraft Through an Alternative Form of Synergy: Phase III." Fischman's project, titled "p-adic Continued Fractions," had also earned him fifth place in the 49th annual Westinghouse Science Talent Search last March (SN: 3/10/90, p. 51).

The two Seaborg winners were selected from among 754 competitors from 46 states, the District of Columbia, American Samoa, Guam, Puerto Rico and six foreign countries: Canada, Ireland, Japan, Republic of China (Taiwan), Sweden and the United Kingdom. The annual International Science and Engineering Fair, administered by Science Service, draws its participants from winners of local and regional high school science fairs. □

Ground zero, dinosaur time: Caribbean Sea

At the close of the Cretaceous period, according to a leading theory, a fiery asteroid or comet crashed into Earth, triggering a series of environmental disasters that killed off a significant fraction of life on the planet, including the last surviving species of dinosaurs. Now two geologists contend that a growing body of evidence points to the Caribbean as the 65-million-year-old impact site.

"I think the evidence is now compelling that the impact or impacts had to be in this region," says Alan R. Hildebrand of the University of Arizona in Tucson.

The debate over the mass extinctions at the boundary of the Cretaceous and Tertiary (K-T) periods has raged since 1980, when a team of scientists proposed the impact hypothesis. While many researchers now accept that theory, a vocal minority maintains that volcanic eruptions or slow climate change caused the widespread death.

Hildebrand and Arizona colleague William V. Boynton report in the May 18 SCIENCE that Haitian rock deposits bear several signs indicating a nearby impact. They have found "shocked" quartz grains in a thick layer of clay deposited at the end of the Cretaceous period, when Haiti was part of the seafloor. Shocked mineral grains, which scientists often view as telltale impact evidence, appear in many K-T sites around the world, particularly in North America.

The K-T clay layer in Haiti is also unusually thick – about 25 times the size of any other such deposit. The Arizona team thinks the clay formed from tiny rock particles that fell to Earth's surface after they were thrown into the air by the impact. The thickness of Haiti's clay layer suggests the collision occurred within about 1,000 kilometers, Hildebrand says.

In addition, the researchers have re-examined some deep-sea sediments collected in the early 1970s from sites in the Colombian basin, to the north of South America. At the level of the K-T boundary, the sediments contain evidence that a huge wave scoured the seafloor, they report.

These deposits and others in Cuba and Texas suggest a K-T crash somewhere between North and South America. Hildebrand and Boynton believe the comet or asteroid landed on oceanic crust, and they propose that a 300-km-diameter circular depression in the Colombian basin may be the impact crater.

Other scientists contend the object crashed into continental crust. Last month, Hildebrand and Boynton's work led one team to suggest Cuba as the site for such a crash (SN: 4/28/90, p.268).

– R. Monastersky