Biomedicine

Patrick Young reports from Bar Harbor, Maine, at the annual Short Course in Medical and Experimental Mammalian Genetics

Of mice and asthma

Efforts to decipher asthma's genetics could get a boost from the discovery of two genes that independently cause airway hyperreactivity in mice. The condition underlies the development of asthma in humans. Roy C. Levitt and Wayne Mitzner of Johns Hopkins University in Baltimore reported the first gene — designated *Ach* locus — in the July FASEB JOURNAL. Now Levitt has announced discovery of the second, called the *Ser* locus, and its preliminary mapping on mouse chromosome 2. "There are discrete genes in the mouse that are responsible for or determine airway activity," Levitt says. "It's apparent these genes are not linked; they are probably on separate chromosomes."

Levitt and Mitzner exposed inbred mice with airway hyperreactivity to serotonin and acetylcholine, two neurotransmitters known to trigger decreased pulmonary functioning in animals and humans with airway hyperreactivity. They found a separate gene controlled the animals' responses to each chemical — thus the gene designations *Ach* and *Ser*. Some mice had one gene and some had both, but either gene adversely affected the animal's pulmonary activity. Levitt cautions there is no evidence yet that these genes exist in humans.

Family and twin studies indicate a genetic factor in airway hyperreactivity and asthma. A number of humans with airway hyperreactivity, however, exhibit no symptoms and their condition requires lung-function measurements to detect.

"Airway hyperreactivity is a heritable trait in humans," Levitt says. "The number of genes and the molecular processes remain to be determined, and we're hoping our animal model sheds some light on this. Airway hyperreactivity is not asthma, but it may lead to an understanding of how airway hyperreactivity develops into asthma."

Gene maps: The sites fill

Understanding where specific genes lie on the strings of DNA that make up the chromosomes can help researchers understand the body's workings and malfunctionings. Scientists increasingly are filling in the details of such gene maps. Estimates put the number of genes in humans and mice at 50,000 to 100,000. Gene mappers have mapped some 1,400 human genes to their respective chromosomes and pinpointed more specific sites for a number of these. "We're discovering a [human] gene every three days at least," says Frank H. Ruddle of Yale University in New Haven, Conn. The mouse map now contains 1,150 genes, 400 of which exist in humans as well and thus allow genetic studies in mice to answer specific questions about human disorders, notes Thomas M. Roderick of the Jackson Laboratory in Bar Harbor, Maine..

Researchers hope a coordinated international effort, called the human genome project, will map the location of all human genes over the next decade. "If we were to do this all in the next 10 years, we [would] have essentially 5,000 genes a year or so to map on average," Ruddle says. "So we've got to increase the rate at which genes are being discovered."

Second neural tube defects

At least 1 child in 1,000 born in the United States suffers from a neural tube defect, such as spina bifida. Mothers who bear one child with such a defect run a 2 to 7 percent recurrence risk in each successive child, depending on where in the world they live. But the risk is not equal for all neural tube defects, report Judith G. Hall and her colleagues at the University of British Columbia in Vancouver, where the overall recurrence rate is 2.1 percent. In a four-year study of 701 children, they found a 3.3 percent recurrence risk for women whose initial child's defect occurred above the spine's lumbar section, but a 0.7 percent risk if it occurred below the T12 vertebra.

Technology

Looking for the sparkle in carbon films

Diamond has a remarkable combination of properties that don't often go together in a single material. Not only hard and transparent, it's also both an electrical insulator and an excellent conductor of heat. Those qualities led physicist Carl B. Collins and his colleagues at the University of Texas at Dallas to consider diamond as a suitable lattice in which to embed atomic nuclei — the working ingredients for a proposed gamma-ray laser (SN: 11/1/86 p.276). That meant finding an efficient way to lay down thin, uniform diamond films on top of silicon, glass and other surfaces.

The diamond-growing method chosen by Collins and his team involves shining intense, brief pulses of laser light on the surface of a block of very pure graphite. The laser vaporizes the surface material, cutting a crater while explosively sending out a high-temperature plume containing ionized carbon atoms. An electric field guides the charged particles to the surface to be coated. Each laser pulse, lasting only 10 nanoseconds, lays down a single layer of atoms over an area as large as 10 square centimeters. The resulting transparent film, about 200 angstroms thick, has a mirror-smooth finish and excellent optical quality, Collins says. The researchers describe their technique and preliminary results in the July 18 APPLIED PHYSICS LETTERS.

What isn't clear is the nature of the carbon film produced. Measurements of the film's index of refraction — how much it bends light — give values less than but close to diamond's refractive index. Unlike graphite, which is a good electrical conductor, but like diamond, the film has a high resistance to electrical current. Those observations suggest the laser-produced film is at least diamond-like, if not truly diamond.

Alternative methods for growing diamond or diamond-like films tend to be slow and require high operating temperatures (SN: 8/23/86, p.118). Moreover, surfaces to be coated usually must be specially treated to receive such films. Surfaces coated by the laser technique need no such treatment. And because much milder operating conditions are used, it's possible to lay down carbon coatings on a variety of materials that would be damaged at higher temperatures. The laser-produced diamond-like coating itself may turn out to be a good seedbed on which to grow crystalline diamond.

Collins and his group have not yet tested their carbon films to see if the films have the right properties for use in a gamma-ray laser. "We don't really know all the details of how the laser process works yet," Collins says. "We have about 20 variables that we aren't used to working with all at the same time. We're spending all our time just trying to master the process variables."

Firing long-distance electrons

Sending a powerful beam of electrons any distance in a straight line is difficult. The beam tends to become unstable, whipping around as the closely packed electrons repel one another. Now researchers at the Sandia National Laboratories in Albuquerque, N.M., have managed to send a high-power electron beam a record distance of 184 feet in a new facility specially designed for studying such beams.

The electrons, in pulses lasting up to two-millionths of a second and rated at thousands of amperes and millions of volts, race down a tube 3 feet wide and 184 feet long. Coils surrounding the tube produce a low-intensity magnetic field that aids in the formation of an electrified gas, or plasma, within the tube. The plasma acts as a "channel" to guide the electron beam down the tube.

Of interest for applications in the Strategic Defense Initiative program, such electron beams may also be useful for high-speed X-ray photography, welding, simulating the effects of nuclear bursts and studying rapidly heated materials.