total annual slaughter, well in excess of 100,000 animals. Because the young lose their prized, downy white fur within the third week after birth, the hunt focused on nursing animals. But a ban on the importation of white-coat pelts by the European Economic Community (EEC) last year (SN: 3/5/83, p. 150) dried up the commercial market for trade involving these newborns. As a result, last year's slaughter fell 143,000 animals short of the federally imposed ceiling for the kill of 186,000.

Only this week, Mark Small, president of the Canadian Sealers Association, told SCIENCE NEWS, "We [the association] have called for a moratorium on white coats." Reached in Wild Cove, Newfoundland, he said, "The pups are out there now and the season is open for taking pups, but there's nobody out there. There are no sealers taking any pups." He added emphatically, "I know for sure that there won't be any pups taken." Asked for clarification, he said he could speak for the 5,000 "landsmen" — land-based sealers from Newfoundland, Labrador and the Magdalen Islands — that there would be no slaughter of animals under one year of age during this year's hunt.

But on Tuesday, Jim Winter of the Canadian Department of Fisheries and Oceans in Ottawa contradicted that, saying the hunt had officially begun Sunday and that the first day's kill totaled 43 animals — "mostly young ones," on the ice. He emphasizes that these were not white coats, but "just after the white-coat stage."

That's impossible, counters Vivia Boe, international projects coordinator for Greenpeace. Reached in Canada, where she and colleagues are now monitoring the hunt, she notes that when escorted into the main herd of harp seals on Feb. 28 by fisheries officials, the only pups she saw were a day old. Clearly, whelping didn't begin until Feb. 27, she says, "which means that today [March 12] the oldest animals are two weeks old." That also means, she says, that the young being killed are white coats.

Kirk Smith, executive director of the Canadian Sealers Association, said he could not confirm that the clubbing of white coats had occurred. However, he did say that in the Magdalen Islands — where the hunt is now being conducted — landsmen occasionally take white coats for their own family's meat consumption. Moreover, he said, in striking contradiction to what his group's president had said, "Our position is very clear: There's no difference in the taking of seals at any age."

"There's a *de facto* moratorium at the moment" on the commercial sale of white-coat pelts, Smith says, so pups would only be killed for individual consumption. Suggesting that earlier media accounts may have distorted his organization's stance, he explained: "We said to the Canadian government that if you need a fallback position, if you need to change policy, then this [white-coat ban] is what we would do. However, we are very pleased to see that the government has not seen fit to change its policy." Hence, there has been no need to curb the killing of the youngest seals.

Both the International Fund for Animal Welfare (IFAW) and Greenpeace are outraged, but not only because of the killing of pups. On March 9, a Canadian airport refused to refuel an IFAW helicopter that had been observing the herd. And while the craft was still grounded, a mob stormed the airport on Sunday and destroyed the vehicle. IFAW's Donna Hart says this just confirms her group's intention to campaign for a U.S. boycott of Canadian fish. Initially, IFAW will focus on "encouraging" the McDonald's, Burger King, Gorton, Mrs. Paul's and Taste o'Sea companies to boycott Canadian fish until the seal hunts end.

"We did a dress rehearsal of this boycott in the United Kingdom starting about six months ago," Hart says, "and feel it's a success. We got two of the major supermarket chains in England to take a moral stand against the seal hunt: Their 600 stores no longer stock Canadian fish products."

— *J. Raloff*

EPA to limit only smallest particles

A major revision of the national clean-air standards affecting particulate matter — pollution consisting largely of dust, soot, dirt and smoke — was proposed by the Environmental Protection Agency (EPA) last week. More than 100 million tons of particulates enter the atmosphere annually. Rather than trying to regulate all of these suspended particles, EPA is now proposing to focus only on those most likely to cause lung damage, those 10 micrometers or smaller in diameter.

EPA's current ceiling on particulates, designed to protect human health, is 260 micrograms (μg) per cubic meter (m^3) of air, averaged over 24 hours, or an annual geometric mean (AGM) concentration of 75 $\mu g/m^3$. The new proposal suggests replacing these standards with a 24-hour limit of somewhere between 150 and 250 $\mu g/m^3$ and an AGM concentration of between 50 and 60 $\mu g/m^3$. Precise limits within the ranges announced probably won't be proposed for a year.

Condemning this proposal, David Doniger of the National Clean Air Coalition (a consortium of nine environmental groups) cited several studies that he said indicated health could be jeopardized at even the lower end of the proposed ranges. The coalition also worries whether particulates might go unregulated altogether for the three or more years it will take to get data and technology to enforce limits on the respirable (10 micron and under) fraction.

— *J. Raloff*

Chipping away at silicon processing

An integrated-circuit chip is built up in layers to create a microscopic, silicon sandwich. It consists of a sequence of metallic films and insulating layers, etched with intricate patterns and doped with traces of elements that alter a layer's properties. The production of such electronic chips requires a complicated, expensive manufacturing process that limits the number of companies and laboratories that can make them. However, current research on the use of lasers and a technique called "chemical vapor deposition" may within a few years bring chip manufacture to, for instance, a university laboratory.

A recent, surprise discovery at the Sandia National Laboratories in Albuquerque, N.M., illustrates the potential value of laser processing. The Sandia researchers use a newly developed technique, called "plasma-initiated laser deposition," for depositing thin layers of silicon on surfaces. The method depends on the interaction between light from an ultraviolet laser and a gas that has passed through a high-voltage, electrical discharge to create a "chemical soup" or plasma of charged, excited molecular fragments. The gas, in this case silane (SiH_4), enters the reaction chamber at a low pressure and passes through a 10,000-volt discharge. Ultraviolet light from a krypton-fluoride laser shines through a window onto the surface of a quartz-glass or silicon wafer. Only when both the plasma is present and the laser is shining does silicon deposit on the area outlined by the laser beam on the wafer's surface. In other words, the discharge activates the gas, and the laser defines where deposition should occur.

The researchers found that at low laser energies, silicon films made up of many randomly oriented crystals form on the surface of a single-crystal silicon wafer. However, when the laser energy reaching a given area is increased beyond a threshold value, the deposited silicon atoms line up in a very orderly arrangement so that the surface-film crystals take on a single orientation.

The results for deposition on quartz plates were even more surprising and puzzling. In this case, Philip J. Hargis Jr. and his colleagues discovered that while low-energy, 10-millijoule laser pulses cause silicon deposition, higher-energy, 30-millijoule pulses cause etching to occur. Simply altering the laser energy changes deposition to etching or etching to deposition. When the experiment was tried on a single-crystal silicon wafer coated with a thin film of silicon dioxide (quartz), the high-energy laser pulses etched the coating until they reached the silicon base. At that point, silicon began to deposit within the etched groove.

Sandia's A. Wayne Johnson, head of the

laser and atomic physics division, admits, "We don't understand this yet." In the case of etching, the discharge-generated plasma species are probably reacting with surface atoms to create volatile products that evaporate, leaving vacancies behind. But the chemistry of both the deposition and etching processes is far from being understood.

Johnson, however, is enthusiastic about the flexibility and efficiency that plasma-initiated laser deposition seems to promise. He sees the possibility of designing a table-top unit for chip manufacture, one in which a single laser can both deposit and etch films as required while different gases are introduced to form the various layers and provide the necessary doping ingredients. He says such a system could be used for creating a small number of special-purpose chips by using the laser to "write" the needed patterns on a chip or for mass producing chips by shining the laser light through patterns or "masks."

Laser processing combined with some form of chemical vapor deposition would considerably simplify the manufacture of integrated-circuit chips. Normally, to create circuitry, a silicon wafer with an insulating coating, or in some cases, a metallic film, must be covered with a polymeric material called a "photoresist," which reacts to ultraviolet light. Light passing through an electron-etched mask strikes the resist, hardening it. Solvents remove the unexposed resist, and acid etches the unprotected surface to create the circuits. Finally, the remaining resist is removed. As each layer of material is added, this set of operations must be repeated. The Sandia process, if successful, would eliminate the messy resist stage and do away with much of the apparatus needed for chip manufacture.

Researchers at the Lawrence Livermore National Laboratory in Livermore, Calif., are working on a similar scheme. Recently, they demonstrated that direct laser writing alone was capable of inscribing transistors and somewhat more complicated circuits on silicon chips. Their process begins with a wafer of silicon coated with an insulating silicon dioxide layer. Silane gas introduced into a vacuum chamber decomposes where the laser is focused on the wafer surface to form spots of silicon. Other gases allow the etching of the silicon dioxide layer to unveil underlying silicon, the doping of exposed silicon with phosphorus to change its conductivity and the deposition of tungsten metal tracks to complete the circuit.

Work on chemical vapor deposition is also going on at the Massachusetts Institute of Technology's Lincoln Laboratory in Cambridge, where Thomas F. Deutsch and his colleagues used the technique to fabricate solar cells. An ultraviolet laser beam causes boron trichloride gas to dissociate and melts the wafer's surface to allow boron atoms to diffuse quickly into the material. *—I. Peterson*

It's all in the immunoglobulin superfamily

An elusive protein that regulates the body's response to tissue transplants, infectious agents and tumor cells finally has been pinned down by analysis of its gene. The protein is the specialized receptor molecule on T-cells, one of the two major cell types responsible for the body's immune response. This receptor allows the cells to recognize foreign substances, the first step in immune system activity.

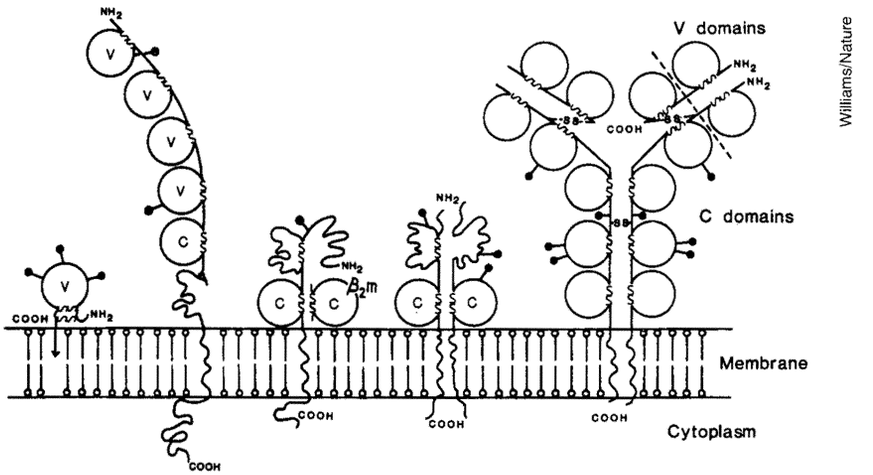
The first analyses of what appears to be the T-cell receptor gene indicate a surprising similarity between the T-cell receptor and important molecules of the other arm of the immune system—receptors on the other major cell type, B-cells, and also the antibodies, or immunoglobulins, which are made by B-cells and which circulate throughout the body in the blood. A better understanding of the molecular basis of immunity is expected to lead to new diagnostics and therapies for immune system disorders and for autoimmune diseases, to improved success in tissue transplants and to more effective vaccines for infectious diseases.

"The molecular nature of the T-lymphocyte [cell] antigen receptor has been the most mysterious and controversial issue in immunology over the past decade," says Alan F. Williams of the University of Oxford in England. He comments on papers in the March 8 NATURE that describe at least one of the T-cell receptor's two chains as resembling, but distinct from, the antibody component called the immunoglobulin light chain. The work was performed independently on the human gene by Yasuke Yanagi, Tak W. Mak and colleagues at the University of Toronto in Canada and on the mouse gene by Stephen M. Hedrick of the National Institutes of Health in Bethesda, Md., Mark M. Davis at Stanford (Calif.) University and colleagues.

These publications follow closely on a report in the March 1 NATURE that puts the B-cell receptor that recognizes immunoglobulins in the same structural "superfamily" as immunoglobulin itself. Keith Mostov, Martin Friedlander and Gunter Blobel of Rockefeller University in New York found that an immunoglobulin receptor contains five domains, which extend beyond the cell, that are "strikingly homologous" to each other and to parts of immunoglobulin. The scientists speculate that the genes for immunoglobulins, for these receptor molecules and for other cell surface molecules involved in recognition of foreign substances are all derived from the same ancestral gene.

This dramatic extension of information about both B-cells and T-cells comes out of work using recombinant DNA. A striking property of immunoglobulin genes was one of several characteristics used to identify the elusive T-cell receptor. The immunoglobulin gene rearranges in the chromosome during maturation of B-cells. Similarly the gene just identified as a T-cell receptor is rearranged in mature T-cells but not in other cell types. As further evidence that this gene codes for the T-cell receptor, Hedrick and colleagues say that antibodies against synthetic peptide fragments made to match portions of the identified gene can inhibit a T-cell response.

"From now on things will move fast," Williams predicts. "All the questions that have been answered for immunoglobulin genes and sequences will be asked of the T-receptor molecules and their expression in T-cell subsets will be eagerly investigated." *—J. A. Miller*



Superfamily portrait at a cell surface: Immunoglobulin (far right) has characteristic variable (V) and constant (C) domains. Other members of the superfamily have similar sections, designated here by circles marked V or C. The B-cell immunoglobulin receptor (second from left) shares five regions with immunoglobulin. The T-cell receptor, not portrayed here, has one V-like and one C-like domain on at least one of its two subunits.