SCIENCE NEWS of the week

Controlling Access to Supercomputers

When the National Science Foundation (NSF) last March established four national supercomputer centers (SN: 3/2/85, p. 135), few people suspected that access to these computers would become a national security concern. The stated aim of the NSF program was to make supercomputers available to as many researchers as possible.

As a result, when the time came for representatives from the institutions hosting the centers to negotiate contracts with NSF, they were surprised to find a clause that called for keeping visiting Soviet-bloc and Chinese scientists away from the machines. Officials from the Departments of State and Defense had insisted that this requirement be inserted.

"We felt it was an unreasonable clause, as did the other centers," says Allen Sinisgalli, acting chief financial officer of the Princeton, N.J.-based Consortium for Scientific Computing, which will operate one of the four centers. "Therefore, we said we could not accept it."

This led to a round of negotiations involving NSF, university and federal officials. The result was new language leaving the question of restrictions on supercomputer access to be settled later, after a high-level government review of the whole problem is completed and perhaps a national policy formulated. In June, two of the centers, one at Princeton and one at San Diego, signed the modified contract.

Says Sinisgalli, "If a national policy came about that restricted access to supercomputers, then we would comply, as we would comply with any other national policy."

However, the centers at the University of Illinois at Urbana-Champaign and at Cornell University in Ithaca, N.Y., have refused to sign the agreement because it leaves a number of questions unresolved. "This particular issue is a delicate one," says Cornell's Kenneth G. Wilson. "On the one hand, there's the issue of the openness of universities. On the other hand, there is the concern of not losing the very considerable lead we have over the Russians in the whole computing area."

"Nothing has been settled yet," says John W. D. Connolly, director of NSF's Office of Advanced Scientific Computing. "But we're pretty optimistic that we can get something that we can live with."

Physicist Michael J. Levine of Carnegie-Mellon University (CMU) in Pittsburgh is one of many university researchers worried about the outcome. As co-director of a recently announced fifth center for advanced computing, involving CMU, the University of Pittsburgh and Westinghouse Electric Corp., he, in particular, has to grapple with this issue.

"There are very serious questions of academic freedom involved here," Levine says. "I do not understand how we can satisfy the security-conscious folk and still encourage use of these machines in the scientific community."

Moreover, there isn't anything particularly special about a supercomputer except its speed, he argues. Almost any problem that can be done on a supercomputer can also be done on a slower machine. It's also relatively easy to build an efficient special-purpose computer, using easily obtainable electronic parts, to solve a specific problem.

"You'd have to restrict everything right down to the microchips," says Levine. "I don't believe that's practical , sensible, feasible or anything else."

The State Department contends that its present focus on supercomputer access is part of a routine national-security review. "We are concerned about Soviet-bloc access to supercomputers for a variety of reasons," says Michael Marks, special assistant to Under Secretary of State William Schneider Jr. Schneider is responsible for technology transfer issues and will ultimately review any policies that are developed concerning supercomputer access.

"We don't want people to go into some sort of a panic that we're about ready to clamp down on all access to supercomputers," says Marks. "It's really not our intent to impede legitimate access to supercomputers by the academic community or the business community or anyone else. It can be handled in a variety of ways, and that's what we're looking at now. I don't see that there are going to be any problems here."

Some observers wonder why attention has focused on the four NSF-funded supercomputer centers. About 17 supercomputers are available to university researchers already, and anyone with enough money can rent time on several privately owned machines. None are off limits to foreigners.

One fear is that any kind of restriction would undercut officially sanctioned exchanges or collaborations with scientists from the Soviet Union, China and other countries. A few federal officials have, at various times, advocated an end to these exchanges. Such controls would also affect many graduate school programs involving foreign students.

The supercomputer access issue comes up at a time when the federal government is also seeking tighter controls on the flow of biotechnology products and manufacturing processes to the Soviet bloc (SN: 6/9/84, p. 360). The Department of Commerce is drafting new export regulations that govern genetic engineering techniques, fermentation processes and other methods that could be used to create new biological weapons.

Despite some signs of an improved working relationship between the national security community and university scientists, these new national-security initiatives threaten the progress that has been made (SN: 9/22/84, p. 183; 12/8/84, p. 358).

One person still concerned about these issues is Robert M. Rosenzweig, president of the Association of American Universities in Washington, D.C. Because most of the significant pieces of paper, including new export control regulations and a statement of national policy on scientific communication, are still in draft form, says Rosenzweig, the academic community has every reason to continue to be concerned and to remain vigilant. —*I. Peterson*

Between the cells: Control by glue

The meshwork of protein and sugar molecules that holds together different layers of cells in the body also influences their structure, metabolism, behavior and development. To examine just how this extracellular matrix affects the cells attached to it, biologists are growing cells on laboratory plates, where the cell's semi-solid support and surrounding solution can be manipulated directly. Now Lola Reid of Albert Einstein College of Medicine in New York City reports that by varying the semi-solid support, scientists can manipulate liver cells in tissue culture to mimic a liver's several physiological states. She and her colleagues are beginning to describe the mechanisms behind this control.

Coaxing liver cells to maintain their normal characteristics while growing in tissue culture was a challenge that Reid found "laborious, but straightforward," she said in a seminar last week at the National Institutes of Health in Bethesda, Md. She and her co-workers spent four years working out the mixtures of nutrients and hormones that would sustain these cells. In contrast, most tissue culture experiments employ cells derived from tumors, because normal cells generally lose their specialized characteristics or die in laboratory culture.

To better mimic a cell's natural environment, Reid began growing the liver cells, called hepatocytes, not directly on plastic plates, but on a gel of collagen, a class of fibrous proteins that make up the biological glue. Reid finds that the type of collagen put on the laboratory plate determines the cells' "differentiation profile."

Cells placed on type III collagen resemble a normal "quiescent" adult liver — the cells maintain their adult characteristics and do not reproduce. Cells placed on type

IV collagen reproduce rapidly for several weeks, also maintaining their adult functions. These cells resemble a liver regenerating after a portion has been surgically removed. Finally, cells on type I collagen resemble cells in a "wounded" liver, for example the liver of a hepatitis patient or a liver repeatedly exposed to alcohol. These cells lose their adult functions, reverting to a fetal form. Reid also observed a surprising "synergy." Cells growing on collagen required fewer hormones than those on plastic.

The same correlations between collagen type and cell characteristics have been determined by microscope examination of liver tissue. Tony Martinez of Hahnemann University in Philadelphia finds that hepatocytes are associated with each of these three types of collagen depending on the liver's condition. In a quiescent liver, the hepatocytes contribute type III collagen to the extracellular matrix. After part of the liver has been removed, the remaining hepatocytes produce type IV collagen. But in a wounded liver, the hepatocytes make predominantly type I collagen.

Other components of the extracellular matrix also influence the activity of liver cells, Reid reports. Among these components are long sugar chains, called glycosaminoglycans (GAGs). These are sometimes found attached to proteins, and then they are referred to as proteoglycans. GAGs or proteoglycans from liver extracellular matrix have dramatic effects on liver cells growing in tissue culture.

In the presence of either active GAGs or proteoglycans, the cells change shape and pack together tightly as in a normal liver. These matrix components also induce the cells to synthesize special membrane structures, called gap junctions, that allow electrical signals to pass from one cell to the next, a characteristic of normal liver cells.

The influence of the components of the extracellular matrix on regulation of liver cell growth and specialization involves the turning on of certain genes and the turning off of others. Some major problems in modern biology involve the underlying mechanisms of such developmental control. The liver cell studies demonstrate that in some cases this regulation relies on different rates of the first step in gene expression: the copying of a gene into messenger RNA. But in other instances the control comes later, via differences in the rates at which messenger RNA molecules are broken down in the cell. Differences in messenger RNA degradation are often cited as a possible mechanism for control of gene expression, but there have been few examples demonstrated. For both types of control, Reid and her colleagues observe differences in the regulation of the "common" genes, active in all cells, and of the genes that provide liver cells with their characteristic properties.

— J.A. Miller

Cretaceous creatures make a comeback

The camptosaurs have resurfaced. A large deposit of bones that belonged to these and other dinosaurs that lived more than 100 million years ago — a period that has yielded few fossil remains — has been uncovered about 75 miles southwest of Fort Worth, Tex. Scientists involved in the excavation say the find should provide new insights into plant and animal life at the time.

"In terms of both quality and abundance of fossils, this ranks among the most productive sites in the world," says paleontologist Louis Jacobs of Southern Methodist University (SMU) in Dallas, who supervised the dig with Phillip Murry of Tarleton State University in Stephenville, Tex., also a paleontologist. "We've probably removed about a half dozen fairly complete dinosaur skeletons, and there are a number of partial skeletons," Jacobs told SCIENCE NEWS. "A lot more are still in the ground."

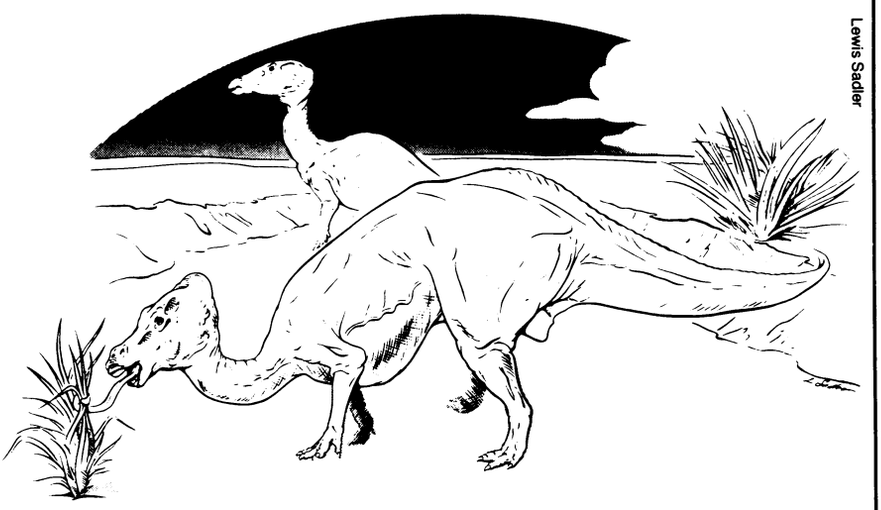
The skeletons appear to represent several previously unknown species, says Murry. "Certain skull bones are unlike any we've ever seen," he explains. Most of the uncovered dinosaurs were plant-eaters related to the camptosaurs, observe the scientists. These relatively small creatures walked on their hind legs most of the time. None of the skeletons is longer than about 10 feet. Murry notes that the new discoveries may flesh out the evolution of camptosaurs during the Cretaceous period, between 135 million and 65 million years ago.

Another skeleton at the site has the jaw and teeth of a meat-eater, he adds.

The dinosaur fossils were found in June by Tarleton State geology student Rusty Branch. He noticed bits of fossil bones exposed on the surface of ridges between gullies that had eroded near the shore of Proctor Lake in northern Texas. The team of scientists then removed the earth surrounding the fossils and encased each skeleton, or several partial skeletons, in a plaster cast for transport to laboratories at SMU.

Research associate Will Downs, director of the laboratory work, estimates it will take from six to eight months to remove each skeleton from its cast. After that, scientific analysis begins.

In addition, says Murry, there are an abundance of bones still to be excavated at the site. For now, however, the scientists will screen soil for bone fragments from other animals that existed in the early Cretaceous period of 100 million years ago.



Lewis Sadler

Camptosaurs of 100 million years ago are depicted in an artist's drawing.

"The layers of earth below the animal bed should have pollen for analysis," adds Murry. "At that time it was early in the history of flowering plants."

The age of the dinosaurs unearthed so far was estimated by the known dates of marine fossils embedded in limestone just above the layers of earth containing the skeletons.

Early Cretaceous dinosaur fossils are scarce and have been found in only a few sites, points out Murry. Dinosaurs became extinct at the end of the Cretaceous period. The oldest known dinosaur was recently discovered in Arizona's Petrified Forest National Park by University of California at Berkeley paleontologists; it lived about 225 million years ago (SN: 5/25/85, p. 325).

The great number of fossils at the Texas site, located on federal land managed by the U.S. Army Corps of Engineers, has discouraged further fieldwork. "We won't remove more than we can handle," says Jacobs. Closer study of what has already been recovered, observes Murry, may reveal "how these fossils relate to their environment and how they fit into a geological time frame."

— B. Bower