

grows, we also increase our efforts on the space frontier."

A complaint often raised about NASA's planetary program recently has been a lack of continuity. With appropriate continuity, Paine said, launch vehicles should be "coming down the assembly line, at a rate that we've all agreed is an efficient rate to produce them, and then we go ahead and put the spacecraft for the outer-planet missions — which, again, will have been built either serially or else in batches of three or four or five — and we put each of those where it does the most good. . . . The biggest expense with any of these spacecraft is the R&D to produce the first one. It costs very little then to

make the additional ones, and we haven't been taking advantage of those economies."

As for the possibility of Martian life — dismissed these days by some researchers but still as vital and potentially momentous as ever to others — Paine takes another view, independent of whether the Big Question can be answered by robot space probes. A staunch advocate of human exploration of Mars as a goal, in part, to get the U.S. space program back on track for the future, Paine told the Boulder meeting: "If there isn't life on Mars, and if there wasn't life on Mars, there's damn well going to be."

— J. Eberhart

Star motions may alter view of galaxy

The motions of the stars in our galaxy yield information relevant to many astrophysical and cosmological questions, particularly those involving the structure and evolution of the galaxy itself. In astronomers' long history of studying such motions, the latest entry is a particularly large one, the just completed Lick Northern Proper Motion (NPM) program of the University of California's Lick Observatory (headquartered on the university's Santa Cruz campus). The NPM will catalog the proper motions of thousands of stars, intending to provide an abundant statistical basis for studying a wide range of questions.

Already the first study done with information from the NPM has found anomalies in the rates at which certain faint blue stars rotate around the center of the galaxy; this in turn raises questions about astronomers' conventional view of the kinematics and evolution of the galaxy.

Proper motion is a star's motion across the sky as viewed from earth. To determine proper motions, astronomers photograph the same part of the sky at intervals of years and compare the photos to see what has moved and by how much. The NPM, which is currently directed by Burton F. Jones and Arnold R. Klemola, consists of two sets of photographs of the northern sky. C. Donald Shane of the Lick Observatory took the first set between 1947 and 1954; the second series began in 1971 and is now 97 percent complete. The more recent observers used the same photographic emulsion Shane used 40 years ago to ensure comparability of the plates. A companion study of the southern sky is being done by Yale University Observatory and the National University of San Juan, Argentina.

Traditionally, two plates of the same field of the sky — from different years — are put into a machine called a blink comparator, which shifts a human observer's vision rapidly between them. The observer notes which images

"move" and marks them down for measurement. Although a blink comparator is still used to select objects for study, the measuring is done by an automatic machine developed by Stanislaus Vasilevskis of Lick. Motions of the stars are measured against a background of distant galaxies, 40,000 galaxies being used as a reference for the motions of 300,000 stars. The final catalog will list stars according to many classes of interest to astrophysicists. Klemola reads the literature to determine such interest and enters the appropriate classes into the program.

In what he calls "a first scratching of the surface" of the information, Lick Associate Research Astronomer Robert B. Hanson used the proper motions of 60,000 stars to study the rotation of the galaxy. The sun rotates around the center of the galaxy, and so do other stars in the flat disk of the galaxy. As the sun moves along, the proper motions of nearby stars show a streaming effect: They move toward us from the direction to which the sun is going and away from us in the direction from which the sun has come. Hanson found that for a group of 16th-magnitude blue stars lying somewhat above and below the disk, the streaming effect seems wrong: Either the sun is not going where astronomers think it is going or these stars are lagging behind the general rotation. Because the sun's motion is confirmed by other studies, Hanson concludes that these blue stars are lagging.

Astronomers have believed that the galaxy consists of two main components, the central sphere or bulge and a flat disk outside it. The stars in the sphere are old and do not rotate — presumably they formed before the galaxy began to rotate. The stars in the plane do rotate. Hanson suggests that either something happened to the blue stars during their development that altered their kinematics, or they are a third component between the other two, and the simple two-component model of the galaxy needs adjustment.

— D. E. Thomsen

Animal patent debate heats up

In a hearing that presaged a confrontation between Congress and the patent office, a congressional subcommittee last week heard testimony on a controversial decision to allow patents on genetically engineered higher organisms (SN: 4/25/87, p.263). Rep. Charles Rose (D-N.C.) announced that he would soon introduce legislation to put a moratorium on the granting of such patents until the economic and ethical implications could be considered by Congress. Sen. Mark O. Hatfield (R-Ore.) is planning to introduce similar legislation in the Senate.

The debate centers on the U.S. Patent and Trademark Office's decision, effective last April 21, to consider all genetically engineered multicellular organisms — including all animals except human beings — patentable. Developers would thus be eligible for the 17-year monopoly on the sale and use of those animals as provided by U.S. patent law. (The board ruled that genetically altered humans could not be patented because ownership of humans is prohibited by the Thirteenth Amendment to the Constitution, which forbids slavery.)

The patent office has delayed processing the first applications for patents on higher animals, but barring any definitive word from Congress the process may begin Oct. 1. Fifteen such patents are already pending.

"While the new patent policy will affect almost every sector of the economy, the most dramatic impact may well be felt in the agricultural community," Rose testified to the committee. "This new policy places major chemical, biotechnological and pharmaceutical companies in the position to virtually take over animal husbandry in America."

Many farmers are concerned that the granting of patents for genetically altered farm animals will result in a new kind of tenant farming, in which farmers will no longer own the animals they use. Cy Carpenter, president of the National Farmers Union, which represents more than 250,000 U.S. farm families, said patenting would likely lead to a corporate consolidation of the livestock industry, with farmers having to pay royalties to patent owners. "Five major corporations now control 120 seed companies that were formerly independent prior to seed patenting," he said. Seed patents have been allowed since 1970.

Others, however, noted at the hearing that the patent system provides financial incentive to develop new ideas into commercially available forms. The patent system is "the engine and the machinery driving the investment in biotechnology," said William H. Duffey, a patent attorney for St. Louis-based Monsanto Corp. He

cited an Office of Technology Assessment estimate that biotechnology will be a \$100 billion industry by the end of the century, and said that "It would be self-destructive to America's leadership position in biotechnology to allow the objections of a few opponents to lead to ill-advised restraints on the patenting of animals."

Moreover, he said, the marketing and use of genetically engineered organisms is already regulated by such federal agencies as the Food and Drug Administration and the Department of Agriculture. The simple act of issuing patents is "morally neutral," he said, adding that "the patent system is certainly the wrong place to regulate matters of ethical, social or moral concern."

A number of environmental, animal welfare and religious groups disagree, however, and have organized a coalition in support of the patent moratorium. "The recent federal government ruling

that genetically engineered animals can be patented, just as automobiles and toasters [are], encourages the exceedingly dangerous notion that living beings are nothing more than commodities," the coalition said in a statement issued at the meeting. "Such genetic tinkering is sure to result in enormous suffering to animals and their offspring for generations to come."

In particular, said Arie R. Brouwer, a coalition member and general secretary of the National Council of Churches, "The combining of human genetic traits with animals . . . raises unique moral, ethical and theological questions."

Indeed, in light of the already successful injection of human genes into animals (SN: 6/29/85, p.405), and the ruling that humans may not be patented, an interesting question remains to be answered: How much human genome does it take to be human? — R. Weiss

A chemical thermostat for fat?

Enticed by theories that there are chemicals in the body that work as a thermostat and signal a satisfied appetite, scientists have been searching for these "adipostats," hoping to better understand and treat the different types of obesity. After finding abnormal levels of a substance called adipisin in overweight rodents, researchers in Boston said last week that adipisin may be a contender for the adipostat title, as well as a marker to differentiate among obesities due to defects in genes, metabolism or just plain will power.

Reported in the July 24 SCIENCE, experiments by scientists at Beth Israel Hospital and Harvard Medical School showed that adipisin is primarily found in adipose tissue (fat), is carried in the bloodstream and is produced in abnormal levels in certain types of obesity. In earlier reports, the Boston group had described adipisin as a substance — probably an enzyme — secreted by fat cells.

To determine adipisin levels in different tissues, the scientists measured the messenger RNA (mRNA) responsible for adipisin production, finding that some obesity syndromes "are associated with profoundly reduced expression of adipisin mRNA and circulating adipisin protein." For example, adipisin mRNA levels in two different mouse models were at least 100-fold lower than those in normal controls. Victims of defective genes, both groups of mice become grossly overweight soon after birth, and have blood sugar and insulin imbalances. Adipisin itself is "radically reduced" in their serum and "virtually undetectable" in their fat tissue, say the scientists.

Suppressed mRNA levels also occurred in animals with chemically induced obesity. Those experiments used mice injected with large amounts of monosodium glutamate (MSG), causing impaired energy utilization and obesity despite a normal appetite. The scientists say these data represent one of the first examples of obesity related to abnormal gene expression. They also suggest that some aspects of obesity may be caused by adipisin deficiency, not by overeating.

But there apparently is no adipisin-based excuse for the can't-say-no crowd. Similar decreases in adipisin were not seen in the "cafeteria-fed" rat model, which the authors say is "more representative of simple gluttony." They add that other experiments indicate there is no problem using the two different species (rat and mouse) in drawing overall conclusions about adipisin.

Based on the recent findings, the authors suggest that "adipisin meets the initial criteria required of the [adipostat] involved in lipid metabolism or energy

Price tag for Price-Anderson Act

Congressional committees scrambled this week to try and beat the clock on renewal of an act that provides coverage to the public in case of a nuclear accident. The apparent failure to renew the act by its Aug. 1 expiration date won't affect commercial plants. But if a renewal is not passed by the end of September, it could leave several Department of Energy (DOE) contractors without coverage.

Called the Price-Anderson Act, the law currently requires each of the nation's 109 reactor licensees to subscribe to the full amount of private insurance available (\$160 million) and be responsible for a retrospective \$5 million regardless of who has the accident, bringing the total to \$705 million available for compensation. The liability for nuclear contractors hired by the DOE is \$500 million, all of which would be paid by the government.

If the act is not renewed, it means that the Nuclear Regulatory Commission and the DOE will not be able to enter into any new indemnity contracts. Existing commercial plants are indemnified for life and therefore wouldn't be affected, but the DOE usually contracts out for about five years, and has contracts expiring Sept. 30 with the Los Alamos National Laboratory, Lawrence Livermore National Laboratory and Lawrence Berkeley National Laboratory, all contracted through the University of California. Without renewal, those operations are no longer covered in case of an accident.

But DOE is looking into several options that would provide coverage to its California contracts, says press officer Jack Vandenberg. One proposal is to use the War Powers Act to indemnify de-

fense-related contractors. This would provide coverage in case of an accident, but requires lengthy contract arrangements with all contractors and sub-contractors involved. And if a company that was not separately contracted by DOE were to cause an accident, it would have to provide its own coverage for the damages, according to a DOE lawyer. Under Price-Anderson, payment is made regardless of who is liable.

In an effort to circumvent such a situation, three House committees responsible for nuclear power issues last week compromised on separate bills and introduced a consensus bill into the House. That bill recommends that the liability limit be set at about \$7 billion, including a retrospective assessment of \$63 million per plant. The measure was expected to reach the House floor for debate late this week, says Kevin Billings, legislative director of the American Nuclear Energy Council.

In the Senate, however, no such consensus was reached, leading two committees to separately introduce their own versions of the bill for consideration. The bills, which set liability limits at \$6.7 and \$7 billion, were not expected to reach the floor for a vote by the Aug. 1 deadline. Although the bills do differ somewhat, most address measures that:

- allow for periodic updating of the liability limit into current U.S. dollars
 - strengthen the third tier of coverage of the act, which now says only that if an accident exceeds liability limits, Congress will take "whatever additional action is necessary"
 - extend the act from 10 to 30 years
 - raise the DOE's liability limit to the same level as that of commercial licensees.
- K. Hartley