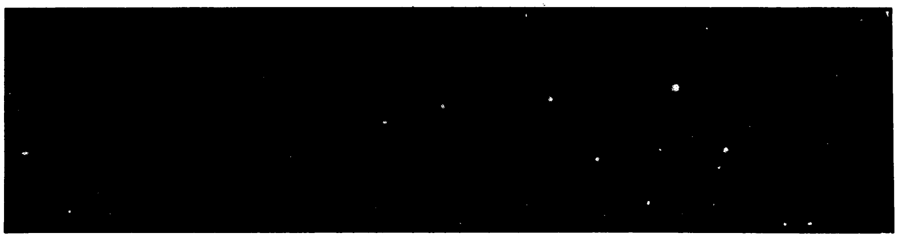
Survey of galaxies sheds light on shape



Photos: Kitt Peak National Observatory

The cluster of galaxies in the constellation Perseus (above) is an example of a high-density region, where galactic and stellar evolution stop early. The one in Hercules (left) is a low density region, where star formation and evolution last longer.

The evolution of galaxies presents astronomers with problems similar to those that the evolution of species presents to biologists. It is not merely whether the chicken or the egg came first, but that we have seen neither the first chicken nor the first egg. The universe presents the galaxies to us in some stage of development and from that astronomers must deduce how they began and evolved.

One theory of galactic beginnings that has gotten a good deal of support lately from the work of Stephen E. Strom of Kitt Peak National Observatory and a number of co-workers says that galaxies began as clouds of gas condensing under their own gravity. Stars began to form later. (There are theories that say star clusters came first.) If protogalactic gas clouds came before stars, there should be a correlation between stellar evolution and cnemical evolution. Heavy elements, especially metals, are made by thermonuclear fusion inside stars and then thrown back into the galaxy. So where the galaxy is brightest, that is, where the most stars are, there should also be the heaviest concentration of metals. In a survey of several dozen galaxies, Strom and collaborators found that this is indeed so (SN: 11/6/76, p. 209). Now, Strom reported at the recent meeting of the American Astronomical Society at Honolulu, a further survey of 180 galaxies shows that the environment in which a galaxy is born has a lot to do with how it evolves.

As Strom puts it, the survey found two basic things, one of which he had anticipated, the other something of a surprise. The anticipated result is that galaxies in clusters that have a high density of intergalactic matter tend to age prematurely. Star formation stops sooner for them than for those in clusters with a low density of intergalactic material.

The motion of a galaxy through dense intergalactic material, Strom anticipated, would set up a ram pressure that would drive out of the galaxy the gas from which new stars could form, bringing star formation to an early end. An early end to star formation, cutting it off after only a few generations, means incomplete evolution of metals. A metal-poor galaxy should look bluer than others, and so they do. This seems especially true of a lot of spirals similar to our own galaxy.

The unexpected result is that the density of the medium in which a galaxy is born can affect the shape of the elliptical galaxy that develops from the protogalactic cloud. In a low-density region, a distended ellipse will form with a gradual trailing off of brightness toward the edges and a change in chemical composition from center to edge. In a high-density region a more compact truncated ellipse forms with a fairly uniform distribution of brightness and chemical composition. Strom's interpretation of this is that in the high-density case star formation begins quickly; a lot of chemical processing occurs in the first generation of stars, and so a fairly uniform appearance results. In the low density case, star formation goes slower, and successive generations of stars leave their marks on the galaxy's brightness and chemical distributions. □

Circling mice: Clue to human disorder

Geneticists are continually on the lookout for animal abnormalities that resemble the inborn errors of human metabolism. While doing routine screening a few years ago, workers in an Edinburgh laboratory discovered that descendants of some Peruvian mice had high levels of the amino acid histidine in their urine, livers, blood and brains. High histidine levels characterize a human genetic disorder called histidinemia, which is found in about one in 15,000 newborns.

The basis for both the mouse and human disorders is a deficiency in the enzyme that breaks down histidine. In the mice strains with increased levels of histidine and its chemical derivatives, a balance defect, causing circling behavior, was common. In humans, physicians disagree as to the effect of the biochemical abnormality. At first it appeared to be associated with mental retardation and speech defects, but now many human geneticists believe histidinemia produces no demonstrable effect on the nervous system.

Experiments on the mice indicate that children of women with histidinemia may suffer the consequences of the disorder. If studies of humans do turn up deleterious effects on offspring, the effects might be avoided by reducing histidine in the prenatal diet.

Henrik Kacser and co-workers at the University of Edinburgh and at the Medical Research Council report in the Jan. 20 NATURE that the balance defect in mice is associated with damage to the inner ear during prenatal development. They found that this damage could also result from a high histidine diet in pregnant mice who, on a normal diet, would give birth to normal offspring. By altering the time of the high histidine diet, the researchers learned that the middle third of pregnancy is the critical period. Other studies have shown that this period is also when X-rays produce damage to the developing ear.

In an encouraging experiment the British researchers found that diet could decrease the number of abnormalities among the offspring of histidinemic mice. Those eating a low histidine diet during the middle week of pregnancy gave birth to 3.1 percent pups with mild balance defects, compared with 25.2 percent with mild or severe defects among pregnant mice on normal diet.

Because any one litter may contain both affected and unaffected offspring, factors beside the mother's chemicals must be involved. Further experiments by Kacser and co-workers indicate that the genetic makeup of the fetus also plays a role in determining susceptibility to histidine damage. In the same histindinemic mother, fetuses with two genes for histidinemia are most likely to be affected, while fetuses with two normal genes are least affected.

"In spite of the considerable reservations which one must have in associating the behavioral aspects in the two species, the further elucidation of biochemical, physiological and nutritional aspects in the mouse may throw light on the etiology of the human disorder," Kacser and colleagues say. □

Conflict of interest at NSF

Sen. Edward M. Kennedy brought the National Science Foundation under some intense criticism last week when he released a report on a conflict-of-interest case that began three years ago. As chairman of the special subcommittee on the NSF, Kennedy called for changes in the Foundation's review policy.

The report, conducted by the General Accounting Office, analyzed NSF's funding of a proposal in 1974 and 1975 by William A. Johnson, a former Treasury Department adviser, now director of the George Washington University Energy Policy Research Project. Essentially, the report found that NSF failed to search out Johnson's source of outside funding, which turned out to be two oil lobbies. With grants totaling $130,000 from NSF, and $125,000 from the oil interests, Johnson wrote a series of discussion papers intended for White House use, which, in fact, argued the case of the oil companies against regulation.

Despite the apparent conflict-of-interest and disregard for normal procedures of review, NSF officials were not alarmed. The funding had been granted under the old Office of R&D Energy Research, an office hastily set up in 1974 to take over the functions of the abolished Office of Science and Technology. When President Ford restored the science adviser, the R&D energy research office was terminated, and NSF went back to its former methods of review. Consequently, NSF said that most of the recommendations of the report had already been implemented and others were under review.

Specifically, the report took umbrage with the following findings:

- Johnson had not asked NSF for permission to print the reports, some of which made about $3,800 in profits for the two oil lobbies;
- NSF had not asked Johnson to name his source of outside funding and was indifferent to the source's interest in the project;
- NSF bypassed its normal mail peer review of the proposal. Instead, it sent the proposal to Johnson's former superior and two of his subordinates at the Treasury Department;
- The oil lobbies used Johnson's papers in their advertisements opposing divestiture without disclosing all sources of funding for the projects.

Officials at the NSF pointed out that regulations now stipulate that grantees disclose all outside funding sources and that NSF approve any commercial publication of reports funded by the Foundation. "The whole area of policy research is under consideration at the NSF and will continue for some time," officials said. "The report has been very helpful." □

Science Talent Search: Top 40 winners

Science Service this week announced winners of the 36th annual Science Talent Search, in which high school students conduct independent research to compete for college scholarships. The winners—7 girls and 33 boys—will take displays of their projects to Washington March 4-8 for final judging for $67,500 in scholarships and awards, provided by the Westinghouse Education Foundation.

The 40 winners, selected from 1,009 qualified entrants, come from 31 schools in 19 states. About half the students come from schools that have never placed winners before. The school with the largest number of winners this year—seven—is Bronx High School of Science in New York City, which has averaged nearly two winners a year since the contest began.

The field of biology attracted the largest number of winners, with 12 students performing experiments in this discipline. Biochemistry is represented by eight projects, math by ten, physics by six and chemistry by four.

Several students used the facilities of nearby universities to perform their experiments. A Florida girl, for example, participated in the summer research program at the University of Florida's Florida Foundation for Future Scientists to study microorganisms that attack tissue surrounding teeth. Some of the mathematics and physics students used computers in their projects. One boy produced a computer simulation of a rapid-transit system to help make scheduling decisions; another developed a computer program on the motion of electrons in crystals.

Not all the experiments, of course, were so elaborate. An Indiana boy played recorded frog sounds through a ceramic model frog, which was immediately attacked when placed near real frogs. The student, a varsity athlete in track and swimming, was thus able to establish how frogs use sound patterns to establish territorial rights and warn of conflicts. A winner from rural Wisconsin studied pollution in a nearby creek. And one adventuresome student, who recently went on a wildlife observation safari in Kenya, studied the relationship between certain birds and plants in his native Pennsylvania.

As in previous years, some of the projects may represent new scientific discoveries. A student from Pennsylvania reports on what he believes to be a previously unknown insect growth hormone. A Bronx High School of Science student, working at Long Island Jewish-Hillside Medical Center, conducted studies of enzyme repression that he hopes will increase understanding of glucose metabolism in the body.

Other projects may someday lead to useful commercial products. A South Carolina student built a laser teletype printer to replace the conventional carbon head printer. To do so, he first had to design and build his own microcomputer. An Oklahoma girl, who wants a career as an industrial or research chemist, studied a rare form of steel corrosion.

This year's 40 winners are:

CALIFORNIA: *John W. Belliveau*, Woodside Priory School, Portola Valley.

FLORIDA: *Christopher M. Lohse*, Cocoa H.S., Cocoa; *William M. Rojas*, Mainland Sr. H.S., Daytona Beach; *Annie L. Murray*, Melbourne H.S., Melbourne; *James R. Driscoll*, Winter Park Sr. H.S., Winter Park.

GEORGIA: *Virginia J. Wight*, Warner Robins H.S., Warner Robins.

HAWAII: *Katherine S. Takaki*, Henry J. Kaiser H.S., Honolulu.

INDIANA: *Lori E. Rhodes*, East Noble H.S., Kendallville; *Kenneth J. Lohmann*, West Lafayette H.S., West Lafayette.

MAINE: *Louis J. Gotlib*, Bangor H.S., Bangor.

MARYLAND: *Arjun G. Yodh*, Springbrook H.S., Silver Spring.

MASSACHUSETTS: *Andrew D. Keller*, Lexington H.S., Lexington.

MINNESOTA: *James U. Bowie*, Mayo Sr. H.S., Rochester.

NEW MEXICO: *Grant H. Stokes*, Los Alamos H.S., Los Alamos.

NEW YORK: *Robert J. Milrod*, Baldwin Sr. H.S., Baldwin; *James G. Propp*, Great Neck North Sr. H.S., Great Neck; *Evan M. Tick*, Jamaica H.S., Jamaica; *Douglas W. Laske, David S. Laster, Andrew Wen-Chuan Lo, Kinkuen Lui, Victor P. Menon, Jonathan S. Roberts, Dorothy Tsang*, Bronx H.S. of Science, New York; *Jeremy M. Frend*, Ramaz School, New York; *Daniel D. Blau* and *David R. Grant*, Stuyvesant H.S., New York; *Paul J. Maddon*, Martin Van Buren H.S., Queens Village.

OHIO: *Paul A. Cahill*, East H.S., Akron.

OKLAHOMA: *Anita B. Carlberg*, Ponca City Sr. H.S., Ponca City.

PENNSYLVANIA: *Richard H. Ebright* and *Paul M. Embree*, Muhlenberg Twp. H.S., Laureldale; *Charles C. Mechem*, Episcopal Academy, Merion.

SOUTH CAROLINA: *Kenneth W. Egan*, Eastside H.S., Taylors.

TEXAS: *Richard C. Schirato*, Skyline H.S., Dallas.

VIRGINIA: *Glenn C. Poole*, Annandale H.S., Annandale; *Lawrence R. Weatherford* and *Nancy E. Zeleniak*, West Springfield H.S., Springfield.

WASHINGTON: *Stephen A. McFadden*, Kennewick H.S., Kennewick.

WISCONSIN: *David G. Kieper*, Antigo H.S., Antigo. □