asked $454 million for its first-year funding, trying to get as many AAP irons in the fire as possible.

The House of Representatives was even harsher, taking out $309 million; it hacked away at NASA plans extending even further into the future. But Apollo escaped almost unscathed, with a trivial cut of one percent.

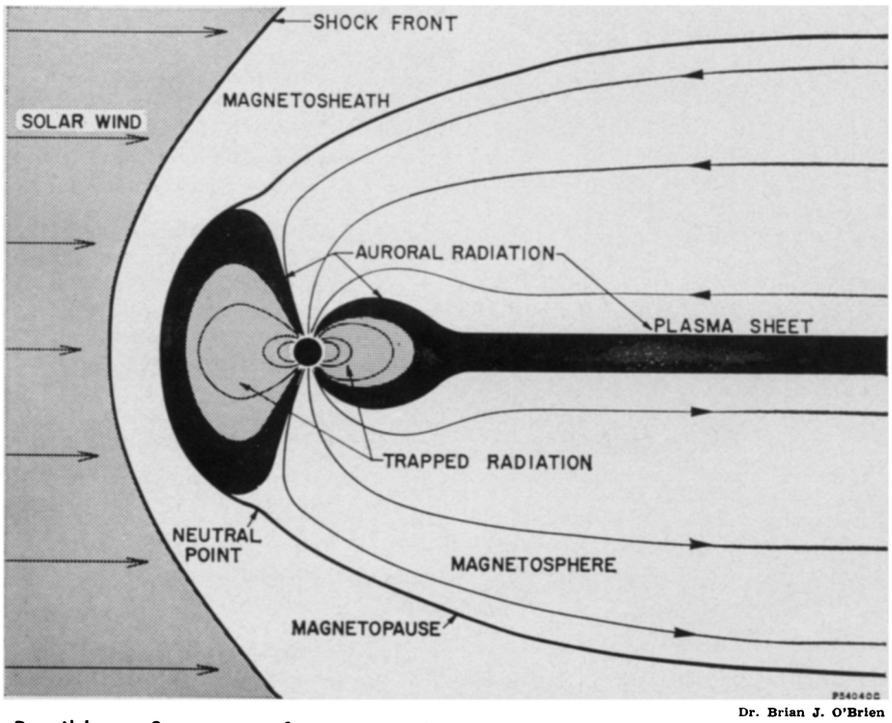
Again the big loser was AAP, to the tune of $75 million. Though the Congressmen cut only $21.5 million from the Voyager program, they lopped off more than half of NASA's $150-million bid to buy additional rockets to launch future missions. Another $20 million in hardware money was trimmed from a $70 million package for the development of a nuclear rocket, an on-again, off-again program which had been especially backed by President Johnson (SN: 4/8). NASA has ideas for nuclear-powered missions reaching decades into the future.

Though the House and Senate bills are both oriented toward keeping NASA's post-lunar plans in better check than was Apollo, the two proposals must still be hammered together into a single authorization. Both bills will be thrashed over in a conference of members of both houses, expected to convene late this week or early next. After several days of haggling, during which various members will stoutly defend pet projects, the resulting compromise will be subjected to both houses for approval. The President, who is expected to sign the bill promptly, may find it on his desk well before the end of the month.

At NASA and at Apollo-building North American Aviation, Inc., most of the pieces of the initial lunar landing program are being picked up, to the tune of lilting press releases touting the project's new look. If all is indeed well, Apollo should finish out its moonward journey almost in the style to which it has been accustomed; after that, NASA's brisk pace will suddenly slow down.

GEOPHYSICS

Lights in the Sky: Still Enigmatic



Dr. Brian J. O'Brien

Possible configuration of magnetosphere, showing auroral radiation domain.

The earliest known sighting of an aurora was in 502 B.C., according to Greek records, and there are descriptions of auroras in the Hebrew Chronicles dating back to 167 B.C.

When the northern lights occur beyond their normal regions, people have been known to become frightened and pray—or turn in fire alarms.

False fire alarms were sounded in Rome in 30 A.D., Copenhagen in 1731. Konigsberg in 1831, New Orleans in 1839 and London in 1847.

Like rainbows, dawn and sunset glow, auroras are linked to the sun, but more mysteriously, says Dr. Sydney Chapman of the University of Alaska, College, Alaska.

Although the others are phenomena of the lower atmosphere, the region of weather, the aurora is planetary. It is caused by hot, ionized gases shot out by stormy regions on the sun, and shaped on a grand scale by earth's radiation belts.

The varicolored arcs and streamers of light result when huge streams of these electrified particles, spewed forth from the sun much like water from a rotary lawn sprinkler, catch earth in their path.

The earth and its magnetic field are confined in a huge cavity, called the magnetosphere, around which the solar wind flows.

The shifting patterns of the aurora over the night sky give scientists evidence of changes in the magnetic and electric fields as the spray of solar particles interacts with earth's environment. Auroras, Dr. Brian J. O'Brien of Rice University believes, play "the-pivotal role in the vast array of solar-terrestrial interactions and magnetospheric phenomena."

Light from auroras, he notes, was the first evidence analyzed, some 60 years ago, that the oxygen and nitrogen in earth's atmosphere "actually extend to altitudes of hundreds of miles." This means mankind inhabits a three-dimensional terrestrial environment.

In some way—not yet satisfactorily explained—in the cavity carved out of the solar stream by earth's magnetosphere, the great bulk of energy is concentrated on a comparatively few electrons and protons that are then accelerated to such energies they plunge into the atmosphere, reaching down to altitudes of about 60 miles. This is the altitude where the auroral light is brightest.

One clue as to how and where charged particles are affected in the magnetosphere may come from evidence that electrons responsible for the production of aurora can be significantly affected by processes occurring as much as 33,000 miles away. Drs. D. A. Bryant, H. L. Collin, G. M. Courtier and A. D. Johnstone of SRC Radio and Space Research Station, Ditton Park, Slough, Buckinghamshire, measured pulsations of electrons detected during a rocket flight last March. The timing of the pulsations enabled the scientists to determine the distance of the cause.

They suggest, in a report in the July 1 NATURE, that a reaction over such a great distance means that the path taken by the auroral electrons from the sun comes close to earth's geomagnetic equator at a distance of 24,000 miles.

Despite some increase in understanding of auroras in recent years, no theory yet advanced satisfactorily explains:

- Why the aurora polaris is more often seen near midnight than at any

other time.

- How the penetrating particles obtain their energy.
- Why the northern and southern lights take the forms they do, splitting up into isolated fingers and streamers as the display progresses.
- The reasons for the color changes, even though the basic cause of the colors is known to be due to oxygen and nitrogen in earth's far-out atmosphere.

Auroras do odd things to radio waves. They disturb long-distance shortwave communications, but boost the distance that television and other very high frequency waves can be received by acting as reflectors.

LEPROSY

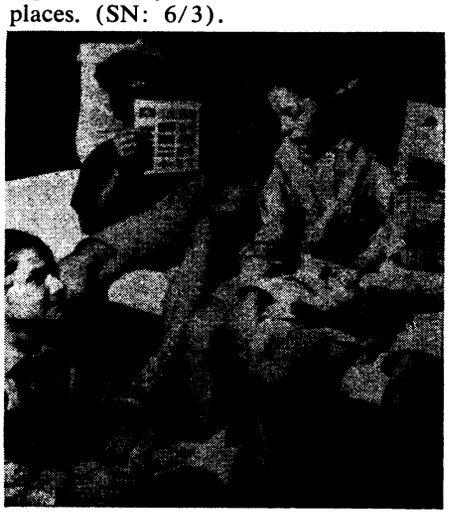
Latin Campaign

Leprosy probably exists in each of the 24 Latin American countries, although only 16 report it. While 171,000 cases are known, a much larger number of persons suffer from some stage of the disease.

Now health authorities are closing in on leprosy with drug treatments and a search for a usable vaccine.

Venezuela, with 11,000 reported cases, is attacking leprosy with injections of the drug DDS (diphenyl sulfone). Its campaign is aimed at the 44,000 contacts who share the homes of known victims. A preliminary study of 300 patients showed that the drug is effective in most cases, preventing the disease from ever reaching its infectious and dangerous stages. Now a broadened effort seeks out 6,000 prospective victims.

Drugs, not vaccines, however, are still the chief weapon. BCG, the vaccine against tuberculosis, has been given to some 8,000 children in Uganda, with apparent immunization not only for TB but for leprosy. It also is being used experimentally in Mexico and other places. (SN: 6/3).



Leprosy contacts in Brazil.

But many more years of testing will be required before a universal vaccine can be assured. In the meantime, early diagnosis in children or adults, many of whom have no symptoms at first, can insure its arrest.

There are three principal types of leprosy, also called Hansen's disease for Gerhard Hansen, a Norwegian doctor who died in 1912. He isolated the bacillus Micobacterium leprae, characterized by lesions of the skin or of the nerves. First is the indeterminate form; the second is the tuberculoid form, which is less dangerous that the third form, which is called lepromatous.

IMMUNE REACTIONS

Minuscule Molecules Sidestep Antibodies

Three years ago a British scientist showed that under some circumstances, the body's normal immune reaction to foreign invaders can be sidestepped. Dr. N. A. Mitchison of the Medical Research Council, London, repeatedly injected very small doses of cow albumin into mice and discovered that the mice, instead of building up antibodies to the foreign serum, became quite accustomed to it.

But albumin is not a particularly toxic substance in any animal, and it was not startling that the mice tolerated the cow protein.

Nevertheless, Dr. Mitchison's work attracted the attention of a group of scientists on the other side of the world; they took his findings a step further. Late last month at a symposium on biological research at Cold Spring Harbor, N.Y., and at the American Medical Association's annual meeting in Atlantic City, some of the recent results of the work of Australian scientists were discussed by Dr. Gustav J. V. Nossal, director of the Walter and Eliza Hall Institute of Medical Research, Melbourne.

The Australians found that the ability of an individual to attack a foreign invader depends on the molecular size of the invader. If the invading molecule is small, the body tolerates instead of fighting it. Large molecules, however, trigger the normal mechanisms of the immune system which swing into action and attack the foreigner, be it virus or bacteria, skin or kidney graft.

Kidney transplants, for example, frequently fail to work because the patient builds up antibodies to fight off the highly antigentic substances in the donor kidney. The donated kidney is recognized by the immune system as something foreign and is rejected. The present procedure for avoiding rejection is to use drugs to paralyze a patient's entire immune system—a procedure which enables him to accept the new kidney, but which leaves him vulnerable to attack by innumerable infectious diseases.

The Australian experiments on mice and rats involved a much more powerful antigenic material than Dr. Mitchison's albumin. Dr. Nossal and his team used salmonella bacteria, highly toxic organisms often associated with food poisoning.

First they injected whole bacteria, about two microns in diameter. Next, a salmonella flagellum, a piece of the bacteria about the size of a virus, was injected. Third, the flagellin material was broken down into even smaller pieces, equivalent in size to about 300 amino acid molecules.

With the first two injections, the rats and mice showed a normal immune reaction. But there was no immune response to the third and smallest salmonella particles, injected into young mice with immature immune systems.

Recently the Australian scientists broke the salmonella down into still smaller particles. Adult animals tolerated these completely after a series of injections.

Using a new combination of biological research tools, the electron microscope with the radioautograph, the doctors traced the path of antigens injected into animals and discovered why the large molecules set off immune responses while the smaller ones escape detection.

Tiny pieces of antigenic materials diffuse through all body tissues, they discovered. Large ones, on the other hand, collect in the reticuloendothelial system—the body's field headquarters for fighting disease. The system is a factory for lymph cells that catch disease causing bacteria, isolate and destroy them.

If an antigenic molecule is large enough to be caught by the reticuloendothelial system, it sets off immune responses. If small molecules get through the defense network, the body tolerates the invaders which, in the case of salmonella, infect it.

Dr. Nossal is calling for a worldwide effort to purify the antigens involved in graft rejection and for further studies to see if this work can be repeated. "If one can purify these antigens then we might get a molecule sufficiently small and of the right structure to evade the reticuloendothelial system and so allow tolerance to develop" before an organ is transplanted he says.

Organ transplantation might then be perfected in the 1970s, he says; allergies and autoimmune diseases conquered in the 1980s; while the control of cancers caused by some antigen such as a virus might be expected in the 1990s.