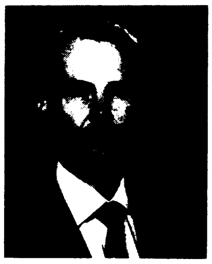
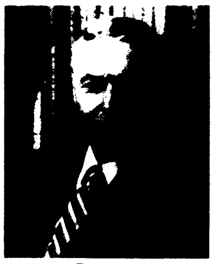
NASA: Beggs leaves, Graham takes over

James M. Beggs, administrator of the National Aeronautics and Space Administration for the last four years, began a leave of absence last week. The action came shortly after Beggs was charged with conspiring to defraud the Army on a weapons contract when he was an executive vice-president at General Dynamics Corp., before coming to NASA.





Graham Beggs

Photos: NASA

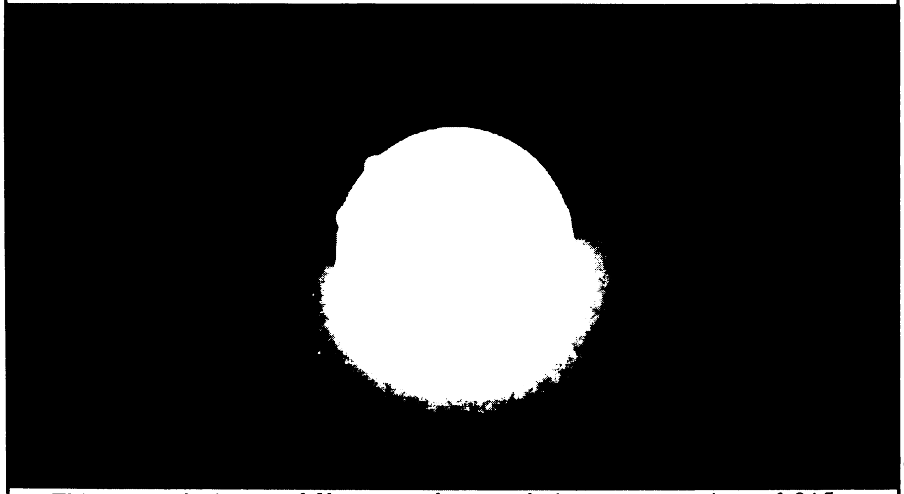
NASA's deputy administrator, William R. Graham, was named acting administrator until the charges against Beggs are resolved. Beggs's departure, though voluntary, came after several members of Congress called for him to resign. In a prepared statement, Beggs said, "For the record, I do not intend to leave the agency. This is not an interim step to a resignation." In a subsequent speech to NASA employees, Beggs was even more forceful. He reportedly labeled the charges against him as "outrageous" and "ridiculous" and part of an "adversarial relationship" created by the federal government against contractors.

Beggs was one of three officers of the St. Louis-based company indicted by a federal grand jury in Los Angeles. They were accused of illegally billing the Army for several millions of dollars in cost overruns on a prototype of the Sergeant York anti-aircraft gun. Ultimately, after about a $2 billion investment of federal funds with a number of companies, the project was canceled because the gun didn't work.

Beggs, as well as General Dynamics, has denied the charges. "There is nothing that I did in the case involved that I would not do again if I had to do it over again," said Beggs, 59. "We acted in an entirely ethical, legal and moral sense . . . I feel confident that . . . I'll be completely exonerated of the charges."

Graham, 48, had been on the NASA payroll just over a week before he was thrust into the interim role. Prior to joining the agency he was senior associate of R&D Associates in Marina Del Rey, Calif., and had served for three years as chair of President Reagan's General Advisory Committee on Arms Control and Disarmament. Reagan, who defended Beggs after the charges were made public, said he was "reluctantly" granting the leave. ☐

First sharp look at a Uranian ring



JPL

This unusual picture of Uranus and the outermost of its nine known rings was made by computer-adding, or integrating, a series of six images taken by the Voyager 2 spacecraft on the way to its Jan. 24 encounter with the planet. The rings were discovered in 1977, when they caused blinks in the light of a star as Uranus moved in front of it, but this is the first picture to show even one of them in a way that was not extremely blurred by earth's atmosphere.

The ring shown, called the epsilon ring, is either eccentric or elliptical, and appears to range in width from about 20 to 100 kilometers. It is also believed to be extremely dark, reflecting about 1 to 2 percent of the sunlight that falls on it, suggesting that it may be composed of carbonaceous material like that covering some asteroids and the dark side of Saturn's moon Iapetus.

Making such a dark object visible, even with the capability of computer-enhancing Voyager's images, required not only the multiphoto sequence, so that the tiny brightness difference between the ring and the surrounding space in each frame could be combined, but also unusually long exposure times. The frames were taken with either 11- or 15-second exposures, producing a cumulative exposure time of 84.5 seconds. But that was not good enough for the narrow ring. The slightest motion of the spacecraft, such as the starting or stopping of its tape recorder, produces vibrations that trigger corrective firings of the craft's attitude-control system, so engineers at Jet Propulsion Laboratory in Pasadena, Calif., had to reprogram the system to minimize the corrective effects as well.

Even with such techniques, however, the other rings, which are narrower still, have remained invisible to the Voyager cameras. The six frames in this picture were all taken on Nov. 28, with the craft about 72.3 million km (44.9 million miles) from the planet. Uranus itself is highly overexposed, due to the long exposure times necessary for the rings. And a number of artifacts — not parts of the real scene — are present due to the extreme computer-processing, such as the dark region just above the planet, the bright region below it and the small, bright projections on its upper left.

The ring appears less prominent in the lower left portion of the image, and more prominent in the upper right, which is consistent with where researchers have expected to find its narrow and wide portions. — J. Eberhart

En route to thought: Recognition and recall

The monkeys roam around, indiscriminately picking up objects, edible and inedible, and putting them in their mouths. Again and again they perform this ritual with the same items. First considered a type of mania, this abnormal behavior occurs in monkeys sustaining damage to a brain structure called the amygdala. Scientists now propose a new explanation for the behavior, and for some other forms of brain damage, based on research aimed at understanding thought processes.

"For these monkeys, looking at the object gives no clue as to what the object feels like and picking it up gives no clue as to what it tastes like," says Mortimer Mishkin of the National Institute of Mental Health (NIMH) in Bethesda, Md. Experiments in his laboratory indicate that certain brain structures, including the amygdala, act as selector switches to allow the association of different types of stored information, Mishkin told journalists at a Cold Spring Harbor (N.Y.) Laboratory workshop.

Mishkin and his colleagues began their investigations of thought by studying how the brain processes sensory input. "The [brain] cortex is like a patchwork quilt," Mishkin says. Each patch performs a computation and sends the result on to the next station.

As Mishkin, Leslie Ungerleider, and other colleagues traced area-by-area the parts of the visual system that are used to identify objects, they were led from the back of the brain forward to the low, outside region called the temporal lobe. Other sensory systems have a similar organization. For the olfactory, gustatory, auditory and tactile systems, signals also travel station-to-station, eventually reaching areas in or adjacent to the temporal lobe.

The function of each area of the brain is determined by assessing monkeys' performance on specially devised tasks, before and after the area is surgically removed. In a revealing test for "recognition memory," the animal is asked to distinguish a novel object from an object it has seen once before.

"Monkeys are incredibly good at this," Mishkin says. A normal monkey correctly selects the novel item more than 90 percent of the time.

The experiments revealed functional connections between the cortex, the outer and evolutionarily newest portion of the brain, and two underlying structures, the hippocampus and the amygdala. These structures are part of the limbic system.

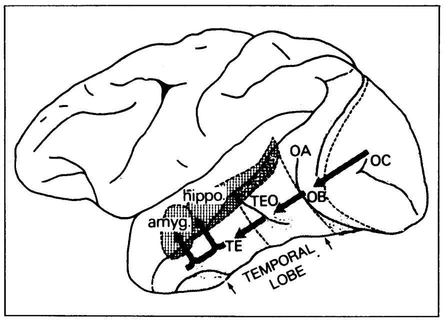
A monkey lacking both amygdala and hippocampus on both sides of the brain shows a severe deficiency in the recognition memory task. This finding was surprising because removal of either the amygdalas or the hippocampal structures had little effect.

The limbic system's role is not limited to visual-information recall, Mishkin and colleague Elisabeth Murray find. If the recognition memory task is performed in the dark, allowing the monkey to touch rather than see each object, the monkey selects accurately unless both amygdala and hippocampus have been removed.

In addition, the limbic system appears to be a site where information stored by different sensory systems can be combined. To test "cross-modal association," Mishkin and Murray presented monkeys with the series of objects in the dark, so the memories were established from tactile information. Then the monkeys made their choice in the light, without handling the objects.

While normal monkeys and monkeys lacking any hippocampus scored about 90 percent correct, monkeys lacking any amygdala were correct only 55 percent of the time, hardly better than chance. "In the absence of the amygdala, the brain can lay down both tactile and visual memories, but it can't compare them," Mishkin says.

The hippocampus serves as a different type of selector, Mishkin now proposes.



Mishkin

Visual information enters the brain cortex at the back (OC) and is processed by a series of stations (OB, OA, TEO, TE). It then travels deeper into the brain to the amygdala and hippocampus.

It provides associations between memories of objects and of positions. In the visual system, for example, a series of cortex stations, distinct from those that run along the temporal lobe, process information about spatial relations.

Mishkin and John Parkinson of NIMH devised a task to test the combined use of spatial and object memory. In step 1, a monkey is shown an object in a given position on a tray. In step 2, the monkey is presented with two copies of that object and is rewarded for selecting the one in the same position as the object in step 1. Normal monkeys, and monkeys without amygdalas, succeed about 80 percent of the time. But monkeys lacking any hippocampus choose correctly in only about 55 percent of their attempts.

The hippocampus and the amygdala share a common ability to store information but differ in which representations they can connect, Mishkin concludes.

What's beyond the limbic system? Connections run in both directions between the hippocampus and the amygdala and another group of deep-brain structures called the basal forebrain cholinergic system. The destruction of these structures in Alzheimer's disease (see story, this page) and other brain disorders may underlie the characteristic memory loss. The basal forebrain structures produce a neurotransmitter called acetylcholine. Mishkin and his colleagues find that a monkey's performance on the recognition memory task can be improved by a drug that increases the amount of acetylcholine available in the brain, and can be decreased by a drug that blocks the acetylcholine receptor.

In recent experiments Mishkin, Thomas Aigner of NIMH and Donald Price of Johns Hopkins University in Baltimore used a chemical to selectively destroy the cells of monkeys' basal forebrains. This treatment impaired the monkeys' ability to recognize whether an object is novel. Mishkin speculates that the basal forebrain plays a role in memory storage, perhaps relating it to emotional context. He says, "We're on the way to begin to think about higher level memory processes." —*J.A. Miller*

On the trail of the Alzheimer's tragedy

It is a tragic disease of mysterious cause — with no known cure and no apparent way to stop its progressive loss of mental acuity. For the estimated 2 million people in the United States who suffer from senile dementia of the Alzheimer type, the brain has inexplicably gone haywire.

Increasing scientific interest in the disease, which is not limited to the aged, has yielded strong evidence indicting abnormalities in the neurotransmitter network in certain areas of the brain (SN: 10/6/84, p. 221). Now, recent research findings offer more etiologic evidence, as well as a new *in vivo* diagnostic approach and a possible new treatment.

According to a report in the Dec. 6 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION (JAMA), a group of researchers led by Duke University Medical Center staff members in Durham, N.C., analyzed the concentration of the hormone corticotropin-releasing factor (CRF) in brains from Alzheimer patients. Using radioimmunoassay techniques, they measured CRF in nine brain regions using postmortem brain tissue from 13 patients who had died of Alzheimer's and from 13 age- and sex-matched controls with no evidence of such disease.

Compared with controls, the Alzheimer brains showed a marked reduction of CRF concentrations in three regions: about 50 percent reduction in the frontal and temporal cortex, and 70 percent in the caudate nucleus. The report apparently is the first to point out CRF deficiencies in Alzheimer's, but the significance of the findings remains unclear. Still, the results suggest that CRF-containing neurons degenerate in Alzheimer's disease, joining the previously described somatostatinergic and cholinergic neuronal damage as possible contributors to the disease's pathology.

Signs of neuronal damage found by microscopic evaluation of postmortem brain tissue are needed to confirm the difficult clinical diagnosis, which still depends on physical examination and psychometric testing. Those parameters may be replaced, at least in part, by a new *in vivo* approach utilizing single-photon emission computed tomography (SPECT), according to another report in the Dec. 6 JAMA by a team from Harvard Medical School and Massachusetts General Hospital in Boston and George Washington University Medical Center in Washington, D.C.

Using radioactive iodine-labeled compounds injected intravenously and a special camera to produce three-dimensional brain images, the researchers studied specific neurotransmitter receptor binding function in a 56-year-old Alz-