science news
OF THE WEEK

Another assault on memory transfer

For centuries scientists have talked about memory lodging somewhere in the brain, but not until the past decade or so have they come anywhere close to locating a physical repository of memory. In the 1960's, for example, some scientists claimed they could transfer learning and memory by injecting brain material from trained animals into untrained animals. Then two years ago pharmacologist George Ungar and his team at Baylor University reported the first isolation, characterization and synthesis of a memory molecule. The molecule had been isolated from brain material collected from over 4,000 rats trained to avoid the dark. When the molecule was injected into untrained rats, it allegedly made them afraid of the dark. The Houston researchers named their molecule "scotophobin," after the Greek for "fear of the dark" (SN: 11/6/71, p. 308).

The scientific world greeted scotophobin with skepticism. The subject has been fraught with pitfalls in the past, and the confirmed discovery of the chemical basis of memory could have a vast impact on brain research, learning, teaching methods and other areas of human life. The scientific journal NATURE was so disbelieving, in fact, that it delayed publishing the Houston team's research results for a year-and-a-half. When finally published, they were accompanied by a lengthy critique by Walter W. Stewart, a chemist at the National Institute of Arthritis, Metabolism and Digestive Diseases (SN: 8/12/72, p. 100). Scotophobin's authenticity as a memory molecule was by no means conclusive. Now, in the March 2 NATURE, scotophobin is again under attack, this time by Avram Goldstein, a pharmacologist at Stanford University.

Goldstein claims that Stewart paid too much attention to the purported amino acid sequence of scotophobin and too little attention to more crucial weaknesses at the heart of the interpretation: whether other scientists can get the same results (a necessity before accepting the validity of a scientific finding) and whether scotophobin contains a reaction to stress rather than a reaction to the dark. Goldstein contends that since Ungar and his co-workers trained rats to fear the dark by shocking them, the rats undoubtedly experienced fear of shock as well as fear of the dark. ". . . If there is a real effect [from scotophobin] at all," he writes, "it is probably a nonspecific factor induced by stress. This in itself could be a discovery of some importance, but is serves no useful purpose to claim the isolation and synthesis of the coded molecule involved in dark avoidance. . . ."

In an interview with SCIENCE NEWS, Ungar responded to Goldstein's criticism. He said other scientists have repeated his experiments successfully, notably David H. Malin of the University of Michigan and Helene N. Guttman of the University of Illinois, whose results appeared in the December 15 SCIENCE. Ungar agrees with Goldstein that the effects from stress must be separated from the effects from dark-avoidance. But he points out that he has shown that crude brain extracts from rats that were stressed but not trained to avoid the dark did not induce dark avoidance when injected into other rats. Only the extracts from rats trained to fear the dark induced dark avoidance in other rats.

Ungar says he has now obtained the same results with the purified memory molecule, and the results are awaiting publication in the German scientific journal NATURWISSENSCHAFTEN. Ungar agrees that other investigators should also be able to obtain these results, and he anticipates they will do so soon.

Whether Ungar's replies will satisfy Goldstein and other investigators remains to be seen. But there is little reason to believe the scotophobin controversy is over. Ungar will be reporting still more research results in April at a meeting of the Federation of American Societies for Experimental Biology. Admits Goldstein, "If this material—whatever its exact structure or state of purity—is truly capable of specifically transferring learned behavior to untrained recipient animals, the discovery certainly ranks among the most fundamental in modern biology." □

Are moonless Venus and Mercury scarred by a satellite's crash?

The inner and the outer planets belong to the same solar system, but there are so many differences between them that astronomers have tended to suspect that they had different origins.

One of the differences often cited is that the outer planets—Jupiter, Saturn, Uranus and Neptune—have a lot of satellites, while the inner planets—Mercury, Venus, earth and Mars (and also Pluto)—have few or none. Neither Mercury nor Venus appears to have satellites; earth has only one; Mars, two small ones. By contrast Jupiter alone has twelve, and Saturn ten.

In the March 12 NATURE PHYSICAL SCIENCES Joseph A. Burns of Cornell University (on leave to work at the Schmidt Institute of Geophysics in Moscow) suggests that the satellite difference is not necessarily basic: The inner planets may have had extensive systems of satellites like those of Jupiter and Saturn and lost them. He proceeds to answer the question how the satellites got lost.

A satellite's interaction with its planet is not static. As the satellite revolves around the planet, it causes tides. The tides may lead or lag behind the overhead passage of the satellite. If the planet spins faster than the satellite moves in orbit, the tide will lead. This produces a slowing of the planet's spin and an increase in the size of the satellite orbit. All known prograde satellites (those going the same way as the majority of rotary motions in the solar system), except Phobos, have this condition and are gradually increasing their distance from their planets. Retrograde satellites have the opposite condition. They come closer and ultimately crash into the planet. Thus retrograde satellites gradually disappear.

Burns now shows that for slow-spinning planets prograde satellites will also eventually crash. Prograde satellites will increase their distance until the planet's "day" is equal to the satellite's "month." Then the tidal condition reverses and the satellite starts to wind inward and eventually crashes. It is precisely the two slowest spinning planets, Mercury and Venus, for which this pull-back mechanism would be very effective, that have no visible satellites. Burns suggests that the effects of such satellite crashes should be visible to flyby spacecraft and suggests that they be looked for.