is rewarded with a drink of water for actively discriminating between visual patterns.

In each case the researchers found, by analyzing brain slices, that some areas of the "seeing" brain hemisphere are actively taking up 2-deoxyglucose, while the "blinded" hemisphere's corresponding uptake remains low. To accurately detect hemisphere-to-hemisphere differences, Mishkin uses a computer to assign a different color to each level of 2-deoxyglucose uptake — red and yellow being more active areas and blue and green being less active. "The differences then stand out in beautiful color," Mishkin says.

Among the differentially active areas is the obvious visual system "that we all know and love," according to Mishkin. It includes the visual relay station (lateral geniculate nucleus) and the striate cortex. The technique detected differential activity in regions of further processing, implicated by other experiments, such as the prestriate cortex and the inferior temporal cortex. "The technique not only confirms what we have been studying, but reveals new things," Mishkin says. For example, the researchers were surprised to find that a cortex fold called the superior temporal sulcus appears to be involved in vision.

In addition to the areas that analyze visual information, the 2-deoxyglucose technique "lights up" brain regions where the visual system contacts other brain systems, showing how visual information can affect the emotions or actions of an animal. "When we see things that are fearful, we are afraid," Mishkin explains. Being afraid involves communication between the visual system and the emotion generating parts of the brain, the old reptilian limbic system. Charlene Jarvis reports tracking visual activity to the limbic structure, the amygdala, as well as to the caudate and caudal putamen. "We have not anticipated that we would be able to trace visual input this far into the nervous system," she says.

Action as well as emotions must be a possible result of visual information. Mishkin suggests that the pathway to the limbic systems is a trigger that then recruits the motor system. Thus, somehow the visual system also connects to the brain's motor areas. With 2-deoxyglucose, Mishkin observed visual activated structures in regions above the temporal lobe, the parietal, and possibly the frontal, cortex. Experiments by Leslie G. Ungerleider, disrupting brain connections, demonstrate that the parietal cortex receives input from the visual striate cortex. She concludes that the two areas, the inferior temporal lobe (on the route to the limbic system) and the parietal cortex, receive differently organized input from the visual cortex. These organizations, she suggests, may reflect the differences in the processing required for the temporal lobe to recognize patterns and for the parietal lobe to localize objects in space, including whether to act upon them or to flee from them.

In Mishkin's experiments, the visual areas were not the only active regions in the actively discriminating monkey. Because the monkey used its hand to press a lever and its mouth to accept the reward, those areas known to be related to hand, mouth and taste also lit up. "We plan to go through the brain millimeter by millimeter," Mishkin says. "This is just the beginning of this method."

The 2-deoxyglucose method is by no means restricted to mapping the visual system, although that has been its most dramatic use so far. In an interview, Sokoloff listed a wide variety of brain problems in which the technique is being employed. They include drug effects, focal seizures, morphine addiction, and the auditory, olfactory and touch information processing pathways. Sokoloff points out that the technique cannot completely replace the microelectrode, because it cannot yet distinguish single cells, but only groups of 20 to 50. However, other researchers are working to improve the method to reach single-cell resolution.

In vision, pathways painstakingly mapped by years of experiments and inferences have now been directly demonstrated for everyone to see. "Suddenly it's very real," Mishkin says, and the technique is eventually expected to speed anatomical analysis of many other brain activities. □

# A close encounter of the solar kind

Observers of pulsars have recorded data that have led them to suggest that there is a wobbly motion not of the pulsars, but of the sun, a motion characteristic of a star bound to a binary companion. If such a companion were any kind of ordinary star, it would be the brightest thing in the sky besides the sun and easily detectable.

Therefore, if the companion exists, it must be a dark object — a dwarf star or maybe a black hole surrounded by weakly radiating accreting matter. In the Oct. 26 NATURE, Serge Pineault of the University of British Columbia points out that a weakly bound binary system would not survive the explosion that would produce the dwarf or black hole from an ordinary star. He suggests, therefore, that what is at issue is a temporary association, a close encounter. The other object could be one of the recently discovered dark X-ray sources.

Pineault argues that such a dark object could be discovered by its gravitational lens effect, the ability of its strong gravitational field to bend rays of light coming from other stars. If a photograph is made of a field of stars with the supposed dark companion in it, the light-ray bending will displace the images of the other stars somewhat. A later photograph, taken after the earth had moved so that the companion was no longer in that field, would show the field stars undisplaced, and so comparisons could be made. If these proposals are correct, Pineault says, "one will have the satisfaction of having observed the (most likely) closest compact object." □

# NAS views on saccharin now in

A year ago November, the President signed into law an 18-month moratorium on the saccharin ban proposed by the Food and Drug Administration. The purpose of the moratorium was to gather more information about any relationship between saccharin and bladder cancer before Congress and the President decide whether the FDA should be allowed to ban it or not. Specifically, a committee of the National Academy of Sciences was to review the scientific literature on the subject and make recommendations on whether saccharin should be banned, and the FDA and National Cancer Institute were to collaborate on a clinical study to see whether persons diagnosed for bladder cancer are saccharin users (SN: 2/11/78, p. 84).

The NAS committee has now completed the first phase of its mission — a review of existing scientific information on saccharin — and its conclusions pretty well uphold the findings that led the FDA to seek a ban on saccharin last year. Saccharin does cause cancer in lab animals, the committee states, and, in fact, the evidence linking saccharin to cancer in rats is so strong that it precludes further tests.

But how about saccharin's ability to cause bladder cancer in humans? Saccharin "must be viewed as a potential carcinogen in humans," the committee asserts, "but one of low potency in comparison to other carcinogens." However, "even low risks applied to a large number of exposed persons may lead to public health concerns," the committee stresses. It estimates that 60 million Americans consume saccharin with some regularity. What's more, it is especially concerned about youngsters who imbibe a lot of saccharin in soft drinks. The reason is that cancers often take years to develop, and ample consumption of saccharin over many years might put Americans in this age group at particular risk of bladder cancer.

Still other conclusions reached by the NAS committee: More research is needed into how saccharin consumed by pregnant women might affect their children, because pregnant rats fed high saccharin diets gave birth to pups with an increased incidence of bladder cancer. It's saccharin itself, rather than any impurities associated with its manufacture, that is of question as a carcinogen. □