theory insofar as presented ... lends substance to the predicted times, locations, and magnitudes of the earthquakes. The council regrets that an earthquake prediction based on such speculative and vague evidence has received widespread credence outside the scientific community."

Among the objections to the predictions voiced by the council and other earthquake researchers interviewed by SCIENCE NEWS are inconsistencies in the data and in the predictions themselves, the "unrealistic" detail of the predicted magnitudes, times and locations and the fact that the theory has not been reviewed and published in the scientific literature. They add, however, that the region is very active seismically and has been identified as having the potential for a large quake. Even so, the council stated, "...none of the members of the council would have serious reservations about being present personally in Lima at the times of the predicted earthquakes." □

A larger role for opiate receptors

When Candace Pert and Solomon Snyder of the Johns Hopkins Medical Institutions reported in 1973 the first evidence for opiate receptors in the brain, it was a landmark finding, since it not only indicated that the brain has neural receptors for morphine but led the way to the discovery of the brain's own natural "morphine," the enkephalins (SN: 11/22/75, p. 327).

But research into the opiate receptors is just beginning, it seems. Pert (who is currently with the National Institute of Mental Health in Bethesda, Md.) and colleagues are now finding that the opiate receptors seem to be involved in much more than the mediation of pain relief. Apparently, they are involved in the filtering of sensory stimuli into the brain.

In the September PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, Pert and Miles Herkenham of NIMH described a simple method for visualizing drug and neurotransmitter receptors in the brain. And in the same paper they reported evidence that opiate receptors coincide within the visual, auditory, olfactory and somatic nerve circuit of the brain and that these opiatergic pathways lead to the limbic area of the brain, which is known to be involved in the processing of emotions. These findings suggested that the receptors control incoming sensory information and that this sensory information is ultimately processed in the limbic area of the brain. In fact, the receptors may even place incoming sensory information in an emotional context along a pleasure-pain continuum.

And in a paper now in press with SCIENCE, Pert, along with NIMH colleagues Michael E. Lewis, Mortimer Mishkin, Evgeni Bragin, Roger M. Brown and Agu Pert, reports that the opiate receptors are not only present in the brain's sensory circuits but that the receptors increase in number as they progress along these nerve pathways, ultimately ending up in the limbic area of the brain. So the receptors may very well be involved in the processing of sensory stimuli in the brain. In fact, Candace Pert and her team suggest that the opiate receptors may work in reverse as well — that is, convey emotional messages from the limbic area to the sensory nerve circuits. This way, they say, "emotional states essential for individual and species survival could influence which sensory stimuli are selected for attention." □

Clues to anxiety: The inosine difference

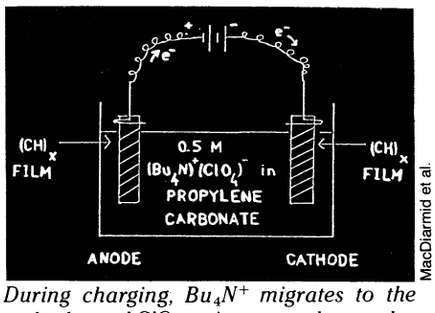
Scientists recently mapped out specific areas in the central nervous system for the benzodiazepines, a group of chemical compounds used to reduce anxiety. Several naturally occurring inhibitors have been found for the most widely used of those compounds: diazepam, otherwise known as Valium. These natural chemicals, one of which is named inosine, bind to the same spots in the brain that Valium does. Large doses of inosine prevent seizures in mice, serving the same function as smaller doses of Valium. The effects of inosine, which is part of the purine group, have now been further defined by researchers at the National Institutes of Health. Jacqueline N. Crawley and colleagues report in the Feb. 13 SCIENCE that when mice placed in cages with lit and darkened sections are given Valium, they overcome normal fears of bright light and venture into the lighted cage areas. But when the mice are given moderate doses of both inosine and Valium, the inosine blocks the effects of Valium and the mice stay in the dark.

Why does inosine inhibit Valium's effects in low doses and mimic the tranquilizer in high doses? Scientists do not know, but results so far suggest that inosine is involved in moderating emotional states and anxiety-related behaviors. "We want to determine a natural substance that is involved in anxiety," says one of the researchers, Paul J. Marangos. "We feel that the purines are good candidates for further research." Human applications, such as the control of anxiety by regulating the brain's large supply of inosine, are still years away. Researchers first must clarify inosine's effects on mice, pinpoint the binding site where inosine and Valium interact and make the jump from animal behavior models to human anxiety. □

A salt and battery without any metals

In research that pushes the electric car one space closer to the road, scientists have developed a lightweight, rechargeable storage cell that involves no free metal or metal ions — an organic battery.

Operation of this battery, designed by Alan G. MacDiarmid and colleagues of the University of Pennsylvania at Pittsburgh, depends on the behavior of the simplest possible organic polymer, polyacetylene, which is composed of carbon-hydrogen units or $(CH)_x$. Polyacetylene, an organic semiconductor, can act as either an electron source or an electron sink. Moreover, upon losing or receiving electrons, its ability to conduct electrons increases about 10^{12}, achieving the conductivity prowess of metals.



During charging, Bu_4N^+ migrates to the cathode, and ClO_4^- migrates to the anode.

Its ability to donate and receive electrons, coupled with its metallic conductivity, makes polyacetylene the stuff of battery electrodes. Two thin pieces of polyacetylene film, about one-tenth millimeter thick, are immersed in a solution that contains tetrabutylammonium perchlorate in the organic solvent propylene carbonate. The tetrabutylammonium perchlorate is a salt that dissociates into the tetrabutyl ammonium (Bu_4N^+) and perchlorate (ClO_4^-) ions. These two ions play a special role when the battery is being charged.

The battery is charged by connecting one polyacetylene strip to the negative terminal of another battery, the other strip to the positive terminal. The strip attached to the negative terminal of the outside battery acts as the sink, accepting electrons; the strip attached to the positive terminal of the outside battery acts as the source, donating electrons. To keep the net charge of this system neutral during charging, explains MacDiarmid, the Bu_4N^+ ions "snuggle up" to the now negatively charged polyacetylene electrode — the electron acceptor, or cathode. Likewise, the ClO_4^- ions move to the positively charged electrode — the electron donor, or anode.

When discharging, this process is reversed: The electrode strip that had accepted electrons now loses them, and the electrode strip that had donated electrons