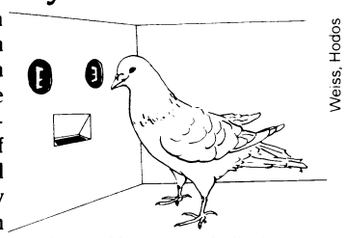
Biology

Julie Ann Miller reports from Minneapolis at the annual meeting of the Society for Neuroscience

Pigeon problems and dyslexia


Weiss, Hodos

Dyslexia is a deficiency in children's reading ability often characterized by difficulty in distinguishing mirror-image letters, such as b and d. Researchers at the University of Maryland recently discovered that some of the pigeons they were using in experiments on the visual system have a similar problem. Nine out of 48 pigeons could not learn to distinguish between visual stimuli that were lateral mirror images (see illustration). These birds were normal in other aspects of their visual abilities, such as acuity and detection of differences in brightness or in the tilt of a line.

Susan R. B. Weiss and William Hodos found that the birds' ability to distinguish lateral mirror images could be improved with a technique reported to improve some dyslexic children's reading skills. When one eye was covered during the testing session, the scientists observed a dramatic improvement in the pigeons' performance on the lateral mirror-image problem. The improvement persisted when the eye cover was no longer used and when the pigeons were trained to distinguish members of a new lateral mirror-image stimulus pair. Weiss and Hodos propose that these birds might serve as a useful animal model of human dyslexia. With pigeons, investigators may be able to discover an underlying anatomical, physiological or neurochemical basis. The pigeon model may also permit development of additional techniques for treatment of dyslexia and perhaps means of preventing the disorder.

Opiate role in stress effect on immunity

Emotional stress can reduce the human immune system's ability to fight disease (SN: 5/24/80, p. 335; 3/1/78, p. 151). The immune system is also influenced by the natural opiate brain products — endorphins and enkephalins (SN: 7/24/82, p. 55). These two lines of research now have been pulled together by experiments that suggest the opiates are the chemical intermediaries linking stress and reduced resistance to disease.

In experiments at the University of California at Los Angeles, for example, rats were subjected to stress by electric shocks to their feet. According to the pattern of the shocks, one of two types of stress results. When electric shocks of 2.5 milliamp are applied for 1 second every 5 seconds for 10 minutes, for instance, opiates appear to be released. The rats become less sensitive to pain and an injection of an opiate blocker will prevent this analgesia. A second pattern of foot shocks, 2.5 milliamps continuously for 3 minutes, does not seem to activate the opiate pathway.

Yehuda Shavit, John C. Liebeskind and colleagues find the two patterns of stress have different effects on the immune system and on susceptibility to disease. The opioid stress paradigm decreases the responsiveness of T lymphocytes, important immune system blood cells. The opiate antagonist naltrexone partially blocks this effect. On the other hand, the second, non-opioid stress paradigm does not alter T lymphocyte responsiveness.

In a second set of experiments the scientists injected mammary tumor cells into female rats after exposure to footshock stress. The survival rate was decreased in the rats shocked with either technique. However, among rats receiving the opioid stress pattern naltrexone administered before the stress increased survival back to the level of the controls. Naltrexone had no effect on the rats stressed with the other electric shock pattern. The scientists conclude, "These results suggest that opioid peptides mediate, at least partly, the effect of stress on the immune system and tumor development."

Topsy-turvy brain exchange in worms

Successful transplants of entire brains have been performed in small marine flatworms. Even when the tiny brain, less than 1 millimeter in diameter, is placed upside down or backwards into the recipient worm, the animal heals and continues its normal, brain-controlled behaviors — moving toward food, moving away from noxious stimuli and righting itself after being flipped onto its back. Harold Koopowitz, Larry Keenan and Lynnae Davies of the University of California at Irvine are determining how the worm's nerve cells find their proper targets. In the case of improperly placed brain transplants, recipient nerve cells join the nearest cut nerve of the new brain, even if it is not their normal pathway. But they still grow to and recognize their correct targets within the brain.

The flatworm, *Notoplana acticola,* is the simplest animal having a brain. The worm cannot regenerate brain tissue but it rapidly repairs cut nerves. In the brain transplants, healing occurs in 2 days and total recovery of function takes only 10 days. With this rapid repair the scientists are investigating the cues cells use to determine their appropriate connections. Because the flatworm is thought to resemble the original stock from which higher animals evolved, Koopowitz and colleagues hope to determine what cellular mechanisms higher animals have lost. Koopowitz says such research may lead to better ways of treating injuries of the human nervous system.

Anxiety and its opposite

Are you too happy-go-lucky? Do you need a medicine to curb your recklessness? In their attempts to learn how the healthy brain keeps anxiety at an appropriate level, scientists are studying drugs intended to reduce anxiety and also chemicals that provoke emotional distress.

At Yale University School of Medicine, D. Eugene Redmond Jr. is examining the hypothesis that cells releasing noradrenaline in the brain area called the locus coeruleus are important in controlling anxiety levels. When that area is electrically stimulated in caged primates, the animals pace their cages, climb to their perches and try to escape. When the area is damaged, they fail to retreat from threats and increase eye contact with higher-ranking animals.

Drugs can increase or decrease activity of the noradrenaline-releasing cells. Yohimbine, for example, increases the activity and causes anxiety in human subjects. Another drug, clonidine, decreases these cells' functioning and has anti-anxiety effects. Redmond reports other results linking these cells with anxiety. He has measured blood levels of MHPG (3-methyl 4-hydroxy phenylethylene glycol), which are considered an index of activity of noradrenaline-releasing brain and spinal cord cells. In patients with a panic disorder, the level of their anxiety was found to correlate with blood concentration of MHPG. In another study, using normal subjects, colleague D.S. Charney reports yohimbine increases plasma MHPG concentration and clonidine decreases it.

A new anxiety-producing substance was described by Claus Braestrup of the Danish Academy of Science and Sankt Hans Mental Hospital. Called FG 7142, it acts on the receptor in the brain where Valium and other benzodiazepine drugs bind. But the new compound has an effect opposite to that of Valium. Observing human volunteers knowledgeable about drug effects — that is to say his colleagues — Braestrup reports FG 7142 induces very strong, recurrent waves of inner tension, a compulsive urge to move, and fear that the subject is about to die. Increased heart rate and blood pressure also were measured. These effects could be rapidly reversed with benzodiazepines. Braestrup says this drug is the first example of a chemical agent that goes beyond blocking the action of a drug and actually produces the opposite effect at the same receptor.