The biological depths of loneliness

Animal evidence is accumulating that might explain how isolation causes mental changes in humans

by Robert J. Trotter

Hundreds of poets have used thousands of words to describe the bitter emotions that often accompany loneliness. Whether it be the alone-in-a-crowd feeling, separation from kith and kin or actual physical isolation, almost every individual has experienced the forlornness that comes from feeling truly separated from the world. Solitude is often relaxing and peaceful, but too much of it can produce boredom and lethargy. In extreme cases, isolation can cause mental stress that leads to anxiety, depression and even psychosis.

The reason isolation can have such profound effects on psychological disposition is basic. Any change in the environment works a change in the organism. Isolation usually implies a decrease in environmental or sensory stimulation. This decrease produces subtle biochemical fluctuations in the brain and nervous system and, in turn, changes in mental processes.

The outward manifestations of these biochemical changes have been recorded many times in animals. Hoyle Leigh of Yale University School of Medicine and Myron A. Hofer of Montefiore Hospital in New York reported behavioral and physiological changes in young rats after isolation from their littermates (SN: 4/29/72, p. 281). Harry Harlow of the Regional Primate Research Center at the University of Wisconsin studied isolated monkeys (SN: 8/1/70, p. 100). He found that six months of social isolation results in seemingly permanent abnormal social, sexual and maternal behaviors. High levels of aggression were particularly apparent. William T. McKinney Jr. and his co-workers, also at the Wisconsin Primate Center, noted that isolated monkeys show severe persistent psychopathological behaviors similar to those of autistic children (SN: 5/13/72, p. 311).

McKinney has been able to achieve partial rehabilitation of these animals by two methods. In one experiment, attempts were made to reestablish biochemical balance by setting up a therapeutic social environment. The isolates,

Photos: Wisconsin Primate Center

Isolated monkeys show severe persistent psychopathological behaviors similar to those seen in autistic children.

who fought with peers, were put with younger animals and began to show signs of returning to normalcy. In another effort, the researchers attempted to work directly on the brain by administering drugs. Chloropromazine was the most effective. The biochemical substances implicated in these experiments are the catecholamines such as epinephrine and norepinephrine and others that are known to exert an important influence on nervous system activity. But to reestablish normal chemical balance, more must be known about which catecholamines and other substances in the nervous system are involved and whether isolation causes increases or decreases in secretion of them.

Answers to these questions could establish a biochemical explanation for psychotic behavior. McKinney has recently sent brain specimens from disturbed monkeys for biochemical analysis. The animals involved had been separated from their mothers. They showed signs of hyperactivity (excessive vocalizing) followed by a period of depression. Preliminary data from analysis of these animals' brains show that major biochemical changes do accompany separation. "There is a lot of evidence," says McKinney, "to reflect changes that would produce nervous system activation both peripherally and centrally." McKinney is not ready to say exactly what is going on but he hopes to have a more definitive analysis ready for publication in the near future. He and his co-workers will then proceed with brain-chemical analysis of monkeys who have been completely isolated rather than just separated from their mothers.

Leigh and Hofer's experiments with separated rats leads them in the same direction. The changes in physiology (increased heart rate), says Leigh, "suggest that the autonomic reactivity of the brain is affected by separation." Hofer is preparing to begin brain analysis of the separated rats to find exactly which brain activities are involved.

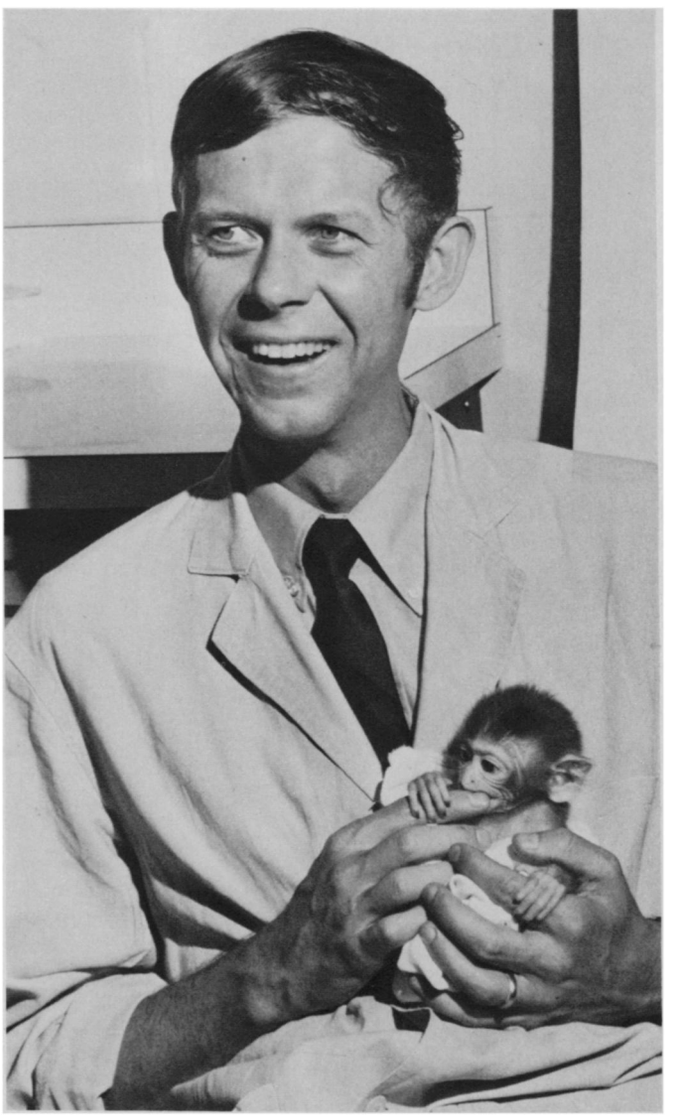
Francis V. DeFeudis at Indiana University is already involved in such work with socially isolated mice—mice kept alone in cages and allowed no physical or social contact with other animals. As with Harlow's monkeys, this procedure produces profound changes in behavior. In the isolated mice this has resulted in the classic symptoms of depression. The mice that came back from isolation reacted violently and aggressively to their renewed social contacts. "They would attack without provocation," says DeFeudis, "and their attacks —in mouse terms—were irrational. They were not fighting for food or water or space in the cage. They were fighting to kill."

Analysis of the brains of these animals showed that the psychological changes were accompanied by biochemical changes. "There is an easy and scientifically confirmed explanation," says DeFeudis. The chemicals that act in the nervous system to suppress abnormal behavior simply are not getting into the system in sufficient quantity. In other words, according to DeFeudis, social isolation significantly lowers the nervous system's capacity to produce chemical inhibitors. He found, for example, that the brains of isolated mice lost much of their capacities to metabolize glucose and manose, two forms of sugar that generate energy in the brain's biochemical reactions. ("I suspect that's true," says Hofer.)

Once brain chemistry has been altered, it is likely that animals will react differently to administered drugs. DeFeudis injected amphetamine into both isolated and socialized mice. The animals were genetically identical but they had significantly different biochemical reactions to the drug. The brains and nerve endings of the isolated mice absorbed more amphetamine. The isolated mice metabolized the drug much more slowly than did the others. Also, the amphetamine in the isolated mice further depressed the abilities of their brains to metabolize the glucose energy source. This, says DeFeudis, did not occur in the mice in colonies.

Do these reactions in mice and monkeys also happen to humans in similar situations? Says McKinney: "This is a kind of way to look at biological changes that might accompany separation in humans." DeFeudis is more explicit. "It may not be especially flattering," he says, "but the biochemistry of mice and men is very similar. We have not yet done the experiments which would confirm our findings in humans, but the apparent analogies to human behavior are overwhelming."

The results have immediate application to men in cages, says DeFeudis. "This shows how stupid it is to punish prisoners by throwing them into isolation. If their problem is aggressive and antisocial behavior," he explains, "the isolation will only aggravate the behavior. They come out of isolation with even less ability to control themselves."



McKinney has found that major biochemical changes accompany separation of a monkey from its mother. He has achieved partial rehabilitation by drugs and by changing the animal's social situation.

DeFeudis does not restrict his speculation to solitary confinement of prisoners. He says human psychotics may be creating their own isolation and carrying it around with them. They develop an ability to shut out any stimulation from social contact. "All of us have this ability," he goes on. "We can close off much of the stimulation from the world around us when we are reading intently or concentrating on a piece of work. Psychotics seem to develop this ability perfectly—they are as isolated as the mice, even though they may be in a crowd."

The research also may have applications for work with drug addicts. Addicts, DeFeudis says, may be seeking isolated environments or creating their own isolation in much the way that psychotics create theirs. The result is that they respond very differently to drugs than do normal persons. For example, he says, troops who came back from Vietnam with drug habits usually lost the habit as soon as they were established again in their normal environments. DeFeudis likens the combat situation, where the drug problem begins, to a form of isolation. A similar situation is seen in drug rehabilitation programs. An addict goes through withdrawal and is physically cured but then picks up the habit again upon returning to the drug culture. DeFeudis also suspects "that for many addicts, criminals and psychotics, we will find that the biochemical aspects of their problems may be the result of prolonged and increasingly successful attempts to withdraw from the environment." An inability to cope with the stimuli of their environment, he says, may have inspired them to shut out the stimuli, to create the isolated environment that produces the biochemical basis for addiction and psychosis.

Most researchers agree that changes in the environment produce changes in the biochemistry of an individual, but not all are ready to draw conclusions about humans from work with animals. Bruce Welch of the Maryland Psychiatric Research Center in Catonsville, Md., says the response of animals to all kinds of drugs changes after isolation, but we shouldn't be too extensive in extrapolation to humans.

The picture is just beginning to smooth out, he says. Isolation seems to be accompanied by a slowing down of turnover and release of what are believed to be neurotransmitters. But most of these substances, he warns, can work either as inhibitory or excitatory factors. Work with animals shows that isolation produces hyperexcitability and increased response to stimulation. Some electrophysiological work with experimentally isolated humans, on the other hand, shows a slowing of brain activity. This, says Welch, indicates a state of decreased arousal.

"Changes in the environment," Welch concludes, "do result in important changes in the brain. As we use animals to study these changes more carefully, we might develop a tool to learn how the brain works, we might learn how biochemical changes affect mental processes. But it is still too early to draw any similarities with humans." □

Ed Lacey Jr.

DeFeudis injecting mouse: "The chemistry of mice and men is very similar."