Behavior

Neural ties that bind perception . . .

Psychologist Donald O. Hebb proposed 50 years ago that animals perceive objects and carry out actions thanks to the collective activity of huge assemblies of brain cells. Since then, however, brain researchers have tended to focus on the responses of one or a few neurons at a time.

Two new investigations, which appear in the Feb. 4 NATURE, cut against that experimental grain and bolster Hebb's notion. Both indicate that human perception and learning arise from the synchronized activity of clusters of neurons. Large numbers of nerve cells may briefly align the peaks and valleys of their electrical outbursts in order to render unified scenes and meanings from diverse sensations.

Other studies, using microelectrodes implanted in the brain, have linked synchronized neural firing in cats and other nonhuman animals to perception and memory (SN: 2/21/98, p. 120).

The new efforts rely instead on brain waves measured by electrodes placed on the scalp. Brain waves arise from synchronized neural activity. Of particular interest are gamma waves, which are the result of thousands of neurons emitting equivalent electrical signals around 40 times a second.

In the first study, directed by Francisco J. Varela of Salpêtrière Hospital in Paris, 10 adults looked at images of either human faces or abstract shapes. They pressed one of two computer keys to indicate what they saw.

Brain tissue involved in vision exhibited gamma activity for an instant when volunteers scrutinized faces but not when they viewed the shapes. These synchronized responses, which Varela's group considers crucial for integrating related sensations into a vision of someone's face, dissolved before any key was pressed. A second burst of gamma activity, which may have helped coordinate an appropriate reaction, arose in motor areas of the brain as participants pressed a key.

The second investigation, led by Wolfgang H.R. Miltner of Friedrich Schiller University in Jena, Germany, indicates that learning fosters synchronized neural activity.

In a series of trials, 16 volunteers saw a flash of colored light that was immediately followed by a mild shock to the third finger of either the right or left hand. Eventually, the flashing light alone evoked surges of gamma activity in brain areas devoted to vision, to integration of sensations with actions, and to representation of the finger that had been shocked.

All this gamma activity vanished when participants learned no longer to expect finger shocks after seeing the flashing lights.

Although the new studies do not demonstrate any precise functions for synchronized neural responses, gamma activity "could well be the mechanism that binds neurons into functionally coherent assemblies," comments Wolf Singer of the Max Planck Institute for Brain Research in Frankfurt, Germany. *—B.B.*

. . . and have a moving impact

The linkage of gamma activity to human perception and learning follows a report that implicates synchronized neural bursts in monkeys' ability to carry out directed movements.

A research team led by Nicholas G. Hatsopoulos of Brown University in Providence, R.I., surgically implanted microelectrodes in the primary motor cortex of two macaque monkeys. The activity of dozens of pairs of motor neurons monitored in this way became synchronized when each animal used a joystick to move a cursor toward a blinking image situated amid seven nonblinking images on a computer screen.

Individual motor cells did not uniformly emit more electrical impulses as monkeys made their move, the scientists report in the Dec. 22, 1998 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES. Synchronized activity in this region, rather than increased firing by single cells, may provide pivotal information about movement direction, they suggest. *—B.B.*

Biomedicine

No genetic link to late Parkinson's

A study of World War II veterans indicates that Parkinson's disease that strikes after age 50 doesn't stem from a person's genetic make-up. Some researchers are now turning their attention to potential environmental causes.

Researchers located 161 white men with both a diagnosis of Parkinson's disease and a twin brother who had grown to adulthood. The sample included 71 pairs of identical twins and 90 pairs of fraternal twins. In only 11 identical pairs did both men have the disease, roughly 16 percent. In only 10 pairs of fraternal twins did both brothers have the disease, about 11 percent.

Although these percentages seem to indicate that identical twins are more likely to share the disease, this was true only in men who developed Parkinson's before age 50, says the report in the Jan. 27 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION.

Among men diagnosed with Parkinson's after age 50, the incidence of both twins having the disease was the same for the two groups, about 11 percent, says coauthor Caroline M. Tanner, a neurologist at the Parkinson's Institute in Sunnyvale, Calif.

Among the 12 sets of fraternal twins in which at least one brother had Parkinson's before age 50, in only two cases did both twins have the disease. In contrast, in the four sets of identical twins where at least one was affected by early Parkinson's, all eight men had the disease. Tanner and her colleagues warn that findings from such a small sample need to be validated in larger studies.

The study "suggests that research is best focused on environmental causes for typical Parkinson's disease," says Jeffrey L. Cummings of the University of California, Los Angeles in an accompanying editorial. Tanner plans to probe the men's habits, occupations, diet, and possibly pesticide exposure.

Roughly 1 in 10 cases of Parkinson's occurs before age 50. This study's findings indicate that researchers should seek a genetic cause for early-onset Parkinson's, Cummings says.

The researchers identified the men by combing through records of 19,842 war veterans born between 1917 and 1927. The men were between 64 and 73 when the data were tabulated.

Parkinson's affects at least 1 million people in the United States. Symptoms include muscle rigidity, tremors, slowness of movement, poor balance, and walking problems. The average age of onset is about 60. *—N.S.*

Deaf people seem to hear signing

When most people hear sounds or speech, the messages are processed in the auditory cortex, a part of the temporal lobe of the brain. A portion of this auditory cortex is activated in deaf people when they interpret sign language, Japanese scientists assert in the Jan. 14 NATURE.

Hiroshi Nishimura's team at Osaka University Medical School in Suita City used positron emission tomography (PET) to measure brain activity in a person who had been deaf since birth. First, the person was shown a still picture of someone signing a word. This elicited little activity in the auditory cortex. Researchers then played a motion video of a person signing many words. A part of the auditory cortex called the secondary region was activated in the deaf person watching the video.

The individual then underwent surgery to receive a cochlear implant, which permitted some hearing. When the researchers played a sound, PET tests revealed that the primary region, but not the secondary region, of the patient's auditory cortex was activated. The patient was also shown a video of a person's hands moving in a meaningless way. This activated the visual cortex, a separate area of the brain, but not the auditory cortex.

These tests suggest that a deaf person's brain changes to make use of the auditory cortex's secondary region for processing sign language. The primary region of the auditory cortex is reserved for hearing sounds, the researchers propose. *—N.S.*