TECHNOLOGY

Remodeling artificial intelligence

Artificial brains, those computers programmed to exhibit seemingly intelligent behavior, have been modeled in many cases without regard to actual brain mechanisms. William B. Gevarter of the National Aeronautics and Space Administration has now attempted to correlate particular brain functions with computer programming capabilities. His work was reported last week at the International Conference on Cybernetics and Society in Washington.

Gevarter's "tentative wiring diagram of the brain" is divided into the three evolutionary brain systems exhibited in humans—reptilian, paleomammalian (early mammal), and neomammalian (new mammal). He said reptilian memory is programmed with innate, "species specific" responses. Paleomammalian memory shows experience-based, emotional programming that tends to develop "relatively permanent" responses. Neomammalian memory is coded and cross-referenced so that it can be entered using any of many random experiences; stimulated responses change with the addition of new experiences and insights. This evolutionarily newest brain is capable of comparing, differentiating and forming patterns; it does not simply spit out standard responses to given inputs, Gevarter says.

In essence, the reptilian brain determines which body part will be used in response to an input, the paleomammalian gives orders and the neomammalian analyzes situations and permits or inhibits emotion. Total brain functioning is a composite of these interconnected controls, each "with its own special intelligence, its own subjectivity, its own sense of time and space, its own memory, motor and other functions."

Gevarter thinks correlating brain function with computer technology, such as he attempted for 22 brain functions, will permit better programming of "smart" computers and more accurate modeling of human behavior.

3-D: It's all done with mirrors

Three dimensional X-ray brain and body scans are limited in the information they communicate by the fact that X-ray photographs are two-dimensional. Assimilating their composite data requires spreading out a succession of radiographs in sequence and mentally stacking together slices of the body as portrayed in individual photographs. It takes fancy mental juggling to assemble the image without confusion. Now Brent Baxter and colleagues at the University of Utah have created what Baxter believes are the first three-dimensional X-ray images of the human anatomy.

Data from the X-ray scans are fed into a computer as electrical impulses. They are reconstructed into a series of images displayed in succession on a cathode ray tube (television screen) and repeated some 30 times a second. The images are projected onto the surface of a flexing mirror. The composite effect is a "floating" luminous image conveying stereoscopic depth. And because light rays coming from the reflected image scatter over a wide, solid (cone-shaped) angle, the image can be simultaneously viewed by several observers over a range of distances and from any direction within the solid angle—just as with laser holograms.

The three-dimensional virtual-imaging display concept was reported as early as 1969, but had to await the advent of the X-ray scanner in 1974 before there was sufficient incentive to develop it commercially, Baxter says. Its primary benefit may be as a diagnostic tool for abdominal scans. Recognition in them is difficult because organ placement varies among individuals, three-dimensional imaging makes recognition easier. So may later use of color.

Baxter expects an eventual price tag of $20,000 on these systems—about half the price of two-dimensional displays now available, he says.

BIOMEDICINE

Tooth loss: Mistaken identity

The human immune response has been accused of many things, including organ transplant rejection, rheumatoid arthritis and infertility (SN: 9/24/77, p. 200). Now it is reported that a misapplied allergic reaction can even knock your teeth out.

The body's own immune response appears to be the origin of at least some forms of periodontal disease, a malady that causes tooth loss for a majority of the world's population, researchers reported at the 174th national meeting of the American Chemical Society last month in Chicago. R.J. Bravman of Tufts University, and Donald L. Everhart and S.S. Stahl of New York University College of Dentistry told the meeting their tests verified the fact that victims of periodontal disease exhibited an antigen-antibody reaction where the gum and tooth root meet. A control group with impacted teeth did not exhibit the reaction.

The new findings were made possible by a recently developed test that can detect the immune response at its primary stage, when antigen and antibody first meet. Previous tests had relied upon secondary characteristics of the immune reaction, such as precipitation and agglutination—phenomena that don't always occur.

The researchers said invading antigens—probably bacterial residues such as dead cells, secreted enzymes or toxins—trigger the immune system. The body mistakes the tooth for an invading antigen, then rejects it altogether.

L-dopa's second generation

In 1967, George C. Cotzias of the Cornell University Medical Center introduced the drug L-dopa to relieve the symptoms of Parkinson's disease: rhythmic tremors, seizing-up of muscles and a peculiar gait. When injected into a patient, L-dopa passed through the blood-brain barrier, metabolized into naturally-occurring dopamine and served as a neurotransmitter of impulses controlling motor functions. In one fell swoop, the drug allowed hundreds of thousands of Parkinson's victims to control their motor functions and to resume normal activities.

Since that time, L-dopa has proved to be only sporadically effective for those victims who have been under medication for a long time (SN: 4/19/75, p. 257). But James Z. Ginos, one of Cotzias's original collaborators at CUMC, has continued the task of perfecting a drug therapy for Parkinsonism. Last month, at the ACS meeting, Ginos reported the development of a new line of dopamine-related drugs. He believes these chemicals will result in further-improved drug regimes for Parkinson's sufferers, and also provide new tools to study little-understood nerve receptor mechanisms throughout the body.

Ginos told SCIENCE NEWS his "NN-disubstituted dopamine analogs" act at the same site as naturally-occurring dopamine. Unlike dopamine, they are able to cross the blood-brain barrier; unlike L-dopa, they undergo no further metabolism before they are taken up by nerve cells to act as signal transmitters.

Ginos says these new drugs have proved effective in tests with lab animals, and are less expensive to synthesize than other drugs now being used to combat Parkinsonism. Because these drugs represent a range of subtle variations of dopamine, future tests with them may clarify the now-obscure differences in dopamine receptors located throughout the body.

But, Ginos cautions, his findings are only tentative. The drugs must first be mass-produced, and they must undergo toxicity tests and receive governmental approval before they can be tested on humans. And that, admits Ginos, may take years.