Behavior

Tracking the brain's language streams

Experiments conducted with three brain-damaged men indicate that interconnected groups of neurons in the brain function as separate "information processing streams" that handle either nouns or verbs, as well as the general concepts underlying these building blocks of language, according to a new report.

Certain brain structures link areas of conceptual knowledge (such as the traits, sounds, and movements associated with birds) to regions stocked with corresponding nouns or verbs (for example, duck, ostrich, and other bird names), assert Antonio R. Damasio and Daniel Tranel, neurologists at the University of Iowa College of Medicine in Iowa City.

This set-up spreads out word and conceptual knowledge in neural networks that, under some circumstances, still process language following partial brain damage, the investigators hold. Other researchers have noted selective impairment of verbs in two brain-damaged women (SN: 3/2/91, p.134).

When presented with pictures of various activities, two of the men studied by Damasio and Tranel named or wrote verbs that correctly described most of the depictions, as did 10 healthy controls. However, in a similar task designed to elicit nouns, the same two men performed far worse than controls, the scientists report in the June 1 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES. Proper nouns, evoked by pictures of family, friends, and famous people, caused the men more difficulty than common nouns, tested with pictures of animals, fruits, vegetables, and tools.

Yet other language abilities remained normal, including reading and writing. They often recalled the same nouns that had eluded them on the initial naming test if an experimenter presented the first syllable of the troublesome word. And their routine conversations often included the same problem nouns.

The third man showed the opposite pattern, identifying most common and proper nouns portrayed in pictures but often failing to come up with descriptive verbs.

The first two men share damage to the same part of the brain's left hemisphere, which lies outside so-called language areas, the researchers note. This region apparently links language structures devoted to nouns with parts of the brain that interpret the various characteristics of an entity, they argue; when the link breaks down, so does noun retrieval.

The third man experienced damage to a different part of the left hemisphere, which may mediate between verb-specific language and conceptual areas, Damasio and Tranel maintain.

Help for obsessive-compulsive kids

The largest systematic follow-up to date of children and teenagers suffering from obsessive-compulsive disorder (OCD) indicates that drug and behavioral treatments offer considerable help—but not a cure—to a majority of youngsters. However, of the 54 individuals tracked, 23 still displayed full-blown OCD, the researchers report. Follow-up ranged from two to seven years after the study began.

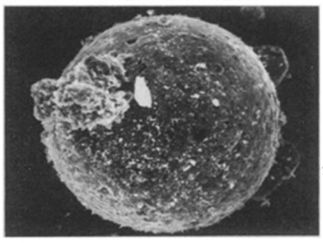
OCD sufferers experience disturbing urges to perform certain activities over and over, such as washing their hands, often for hours every day.

All but two youngsters in the study took medication during part or all of the follow-up period. Many relied on an antidepressant drug that boosts levels of the chemical messenger serotonin in the brain (SN: 5/21/88, p.324). The 18 participants who also received behavior therapy, which teaches ways to reduce anxiety and control OCD symptoms, improved about as much as those who received only drugs.

Henrietta L. Leonard, a psychiatrist at the National Institute of Mental Health in Bethesda, Md., and her colleagues describe their findings in the June ARCHIVES OF GENERAL PSYCHIATRY.

Materials Science

A recipe for microwave semiconductors



Barron, Landry/SCIENCE

Scanning electron micrograph shows a spherical chalcopyrite crystal. The particle formed when scientists heated metal powders in a microwave oven.

Two researchers have discovered that the kitchen-counter microwave can be a handy tool for making bulk materials used in semiconductors.

Andrew R. Barron and Christopher C. Landry of Harvard University found a faster and easier way to make chalcopyrites, materials used in semiconductors for solar cells.

Scientists prepare extremely thin films of chalcopyrite and layer them to build semiconductors. Making the chalcopyrite is the hard part, though. The conventional method requires days of high-temperature and high-pressure conditions to convert a mixture of elements to crystalline chalcopyrite.

In the June 11 SCIENCE, Barron and Landry report that they can now make chalcopyrites in just three minutes. They mix the proper ratio of copper, indium, and sulfur powders and seal them in a quartz tube. Then they place this reddish mixture in a microwave oven and zap it for one minute. (Metals usually explode in a microwave oven, but not if they are in powder form.) After shaking up the contents, the researchers cook the mixture for another two minutes. The result is a bluish-gray crystalline powder.

Analysis by X-ray diffraction shows the product to be a chalcopyrite called copper indium disulfide. The pure elements no longer exist, according to the results of X-ray photoelectron spectral analysis. The researchers also made a chalcopyrite with selenium in place of sulfur.

A variety of interesting compounds can probably be made in a microwave, says Barron. Because the oven allows scientists to heat and cool a substance very rapidly, researchers can create and study unusual phases, he says. "You can make phases that perhaps nature never intended," he adds.

Barron and Landry are now trying to develop their method to make chalcopyrites of consistently high quality for use in semiconductor devices.

Tooth-building material for dental care

Healthy teeth are strong bulwarks of crystalline calcium phosphate. Cavities and painful sensitivity to hot and cold foods result when these tooth minerals are lost. Scientists have now found a way to replace this same tough material. Their discovery could lead to toothpastes, mouth rinses, and even chewing gums that remineralize teeth.

Dental researchers have long sought a way to make calcium phosphate dissolve and then recrystallize on teeth. And they needed this process to happen fast – in just five minutes – in order for the material to do its trick during tooth-brushing.

At the National Institute of Standards and Technology in Gaithersburg, Md., researchers led by Ming S. Tung have developed a form of calcium phosphate that fits the bill. It's amorphous – that is, there's no consistent order to the material – so it dissolves quickly and easily. It also precipitates on teeth in the hard crystalline form.

The American Dental Association has patented the fluffy, white material. Enamelon, Inc., a company in Yonkers, N.Y., has begun to make gum and toothpaste with it and to test these products in clinical trials. Other companies have shown interest in developing a mouthwash. Tung says his group's preliminary results suggest that rinsing with amorphous calcium phosphate does effectively treat temperature-sensitive teeth. "The beauty of this is that it's preventive," he adds.