Talking to the quiet brain

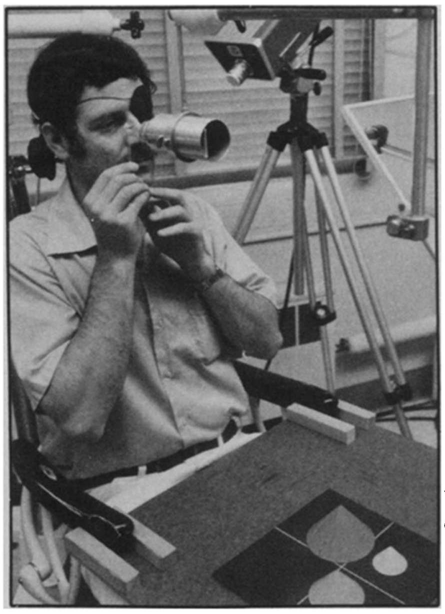
Half of your brain can't talk. At least, that has been the theory. In most people, a portion of the left hemisphere of the brain seems to do all of the talking. It has control of verbal processing and output. The corresponding area in the right hemisphere is thought to specialize in more intuitive talents such as orientation and relationships in space, creative spatial visualizing and the appreciation of music and form. But ongoing research, with the aid of a recently developed optical testing device, may bring about some changes in split-brain theory. It now appears that your right or "quiet" brain can talk—with the vocabulary of a 14-year-old and the syntax ability of a 5-year-old.

Biologist Eran Zaidel has developed an optical system, called the "Z lens," that makes possible communication through vision with either hemisphere of people who have undergone split-brain operations. The operation involves severing of the corpus callosum, the nerve trunk that provides communication between the hemispheres. This rather serious procedure has been used in attempts to limit epileptic reactions to one hemisphere.

Roger Sperry and R. E. Meyers pioneered split-brain research in the 1950's with cats. Since then, split-brain individuals have been tested in a variety of ways in attempts to understand the specializations of the two hemispheres. Research has been hampered, however, by the fact that visual information from either eye goes to both sides of the brain. This makes it difficult to tell exactly which half of the brain is responding to which information. Zaidel, who works in Sperry's lab at the California Institute of Technology in Pasadena, has solved this particular problem with his "Z lens."

Zaidel's system is used in this way: To confine visual input to the right hemisphere, a patch is placed over the left eye and a custom-made contact lens is fitted to the right eye. The subject then looks through a small tube and lens attached to the contact lens. A half-patch is fitted into the tube that blocks out the part of the eye's retina that feeds information to the left hemisphere. Because the eye is in constant motion, it has been almost impossible to limit visual input to a particular area of the retina. The Z lens solves this problem. With it, subjects can see normally, but they can see only in one hemisphere.

Using this system, Zaidel has found that the right hemisphere can understand relatively complex spoken sentences and can read single words but not long phrases and sentences. A word like "horse," for instance, is spoken by the examiner. Then the subject's right hemisphere is shown four pictures of animals, one of which is a horse. Both hemispheres hear the word, but only the right one sees the pictures.



Floyd Clark, Caltech

Zaidel communicates with the right brain.

In Zaidel's experiments, the split-brained subjects were able to point with the left hand (controlled primarily by the right hemisphere) to the horse.

More and more complex words were then used, and Zaidel found that the right hemisphere was only about two years behind the left in language development. The syntax test consisted of listening to sentences of increasing complexity. The right hemisphere scored at about the level of five-year-olds. Surprisingly, however, the right hemisphere understood basic grammar, including tenses and the difference between the active and passive voices. This finding supports the theory that the hemispheres develop concurrently and are equipotential with respect to all functions up to the age of five. After that, language specialization is thought to begin in the left hemisphere while other types of specialization begin in the right. For example, if a child younger than five loses the linguistic left hemisphere, the right will take over the spoken language capabilities. If use of the left hemisphere is lost after the age of 13, little compensation takes place and the child will usually not learn to speak more than minimally.

Zaidel's research may elucidate certain areas of cerebral specialization, but it may also have clinical applications. It could point the way toward tapping the potential of the right hemisphere in people who have lost the use of their left hemisphere due to stroke or accident. "We know," he says, "that the right hemisphere can support a lot of language, but it has to be trained in special ways that fit its unique mode of information processing." The "Z lens" may lead to a better understanding of this uniqueness. □

Missing neutrinos: A competing force?

One of the standing mysteries of solar physics is that the sun does not give off as many high-energy neutrinos as the nuclear processes that theory supposes to happen there ought to yield. Numerous suggested explanations have been put forth including the idea that the sun's nuclear furnace has shut off and the notion that the neutrino may be an unstable particle and decay into something else on its way to the earth.

A somewhat less radical approach to the question is to ask whether there are not processes that do not produce high-energy neutrinos but might compete for raw materials with those that do, and thus lessen the flux of high-energy neutrinos. Such a reaction is possibly proton plus proton yields deuteron plus positron plus neutrino, which though it produces neutrinos, does not produce the kind being looked for from the sun. Such a reaction could occur in the debris from the collision of two helium-3 nuclei, but the best theoretical estimates were that its rate would be much too small for laboratory detection.

In the July 7 PHYSICAL REVIEW LETTERS R. J. Slobodrian, R. Pigeon and M. Irshad of the Université Laval in Québec city report experimental evidence that the stated reaction occurs more frequently than supposed. They bombarded a helium-3 target with helium-3 nuclei accelerated to 13.6 million electron-volts. They obtained a spectrum of deuterons from the collisions that leads them to believe the reaction happens at a fair rate.

The implications go beyond a possible contribution to the mystery of the missing high-energy solar neutrinos and into other important questions in current particle physics. The Laval physicists report that the reaction occurs with a cross-section (probability) too high for it to be governed by the weak interaction, which would normally be expected to mediate an interaction of this kind. They suggest that the cross-section may be evidence for the existence of a new kind of interaction, a new class of natural force with a strength intermediate between that of the weak interaction and that of electromagnetism. There have been theoretical speculations of such a thing by John N. Bahcall and Tullio Regge, who propose that this force is mediated by a massive uncharged particle of the boson class that can interact with neutrinos with a strength 100 million times that of the weak interaction.

Alternately, there's a possible connection to the odd, newly discovered psi-J particles that are causing such a flurry. In a footnote the Québec group suggests that the psi-J's could be involved in the mediation of this intermediate-strength force. □