

## Culture molds the brain

A human being is born with only 25 percent of his eventual brain weight. Although he has most of his neurons, the working sensing units of brain activity, these cells are densely packed in his small skull and constitute something like the bare bones of mental life. Very rapidly until the age of four, and more slowly until the age of 12, the 10 billion neurons enlarge and put out an increasingly complex mesh of connecting links.

While neurons are swelling and elaborating, other cells, once considered only grocery stores for the neurons, but now implicated in learning, are rapidly increasing in number. Growing over, around and among the neurons these glial cells are responsible for most of the weight increase of a child's brain.

**In other words,** radical changes take place in the structure and organization of the brain after birth. In a very real sense, then, the brain continues to construct itself in life, sharply influenced by a child's personal and cultural experiences.

Throughout life, the brain is biologically active, never static. The neurons rotate rapidly and send out streams of protoplasm. Nerve endings move as though continually testing their compatibility with the surfaces of other cells. Glia swarm over the neurons.

This is the view of the brain which has been available to the neurosciences in the past several years. It destroys the notion that the brain is some kind of precast organ that is simply the biological substrata for an immaterial mind.

**To neuroscientists** the dynamic brain is the mind; a division between mind and body no longer exists.

Considering the gap between recent neuroscience and popular concepts, it is not surprising that an eloquent neuroscientist, Dr. Robert Livingston of the University of California at San Diego, startled the recent meeting of the American Association for the Advancement of Science when he suggested that something as immaterial as cultural background can create a biologically different brain.

But that was his thesis: "What people call common sense is what they learn before the age of 12," Dr. Livingston declared. "In general we get committed to a cultural set by that time." The physical brain is shaped in part by the language, images and metaphors of man's origin and from then on his brain is "committed to a set of values and a world view that is profoundly culture-bound. Its entire vast inven-

tory of images is peculiar to the place and time of the child's upbringing. Thereafter these experiences will exercise a controlling influence on all future perceptions, judgments, motives and behaviors." And they are bound into the biological matrix of his brain.

**Dr. Livingston's** views are bound to stir controversy.

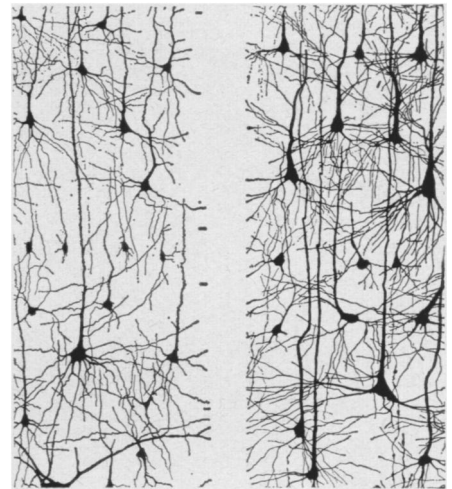
His colleagues cannot deny that the individual and, by extrapolation, his brain, are shaped by culture, since all permanent learning makes biological changes in the nervous system. But the subject is a sticky one, since it gives reason for cultural prejudice. Moreover, these brain differences are not detectable at the anatomical level but are surmised from behavior.

An individual, for instance, shows the effects of culture in the choice of color and form at about three years of age. Before that cultural origin is not evident in his choices. The ability to learn a new language without accent ends about the age of 10. By age 20, many things, such as playing a musical instrument, have become difficult, if not impossible, to learn. This is the age presumably when the brain stops growing and begins shrinking.

Dr. Livingston believes this is the time when the nervous system has gained some degree of frozen commitment to a view of the outside world, a view which becomes increasingly difficult to change with increasing age. It sees and hears only some things, and, through filtering mechanisms in the brain and sense organs, distorts incoming sensory data to fit an earlier, established, culture-bound viewpoint.

A farmer, for instance, will see a different hatchet than the city man. A black man will see different things in ghetto riots than the white man. And a young American, growing up with the sensory and linguistic influence of television, will see and hear a different country than the one the older generation experienced.

**"Thank God** succeeding generations don't have the same lens system," says Dr. Livingston. "We'd be on dead center if they did." Dr. Livingston's argument with his colleagues, however, concerns the location of the lens system. He maintains, on the basis of animal experiments, that the nervous system filters out information at the very beginning stages of input, in the visual and auditory receptors. Thus, much data never reaches the conscious brain for analysis. For instance, a dog which learns to expect 10 flashes of light per second will continue to see 10 flashes



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*Neuron growth from 3 to 15 months.*

even though the experimenter has slowed the light to six flashes. Electrodes implanted in the dog's retina demonstrate that the nerve was sending 10 flashes to the animal's brain, not six. Presumably, the dog, remembering 10 flashes, interposed a filter to incoming signals. True data never did reach higher centers.

**"Some filtering** is done at the peripheral level. That's a fact," says Dr. Grant Rasmussen, neuroscientist at the National Institutes of Health, who has done work on the filtering mechanisms. In some cases, this feedback mechanism prevents the receptors from discharging, says Dr. Rasmussen, but, he adds, the facts are not well established. It has not yet been proven that such feedback control over the senses exists in higher primates and man.

Many neuroscientists prefer to think the higher brain itself is the filter and that most sensory data are available to it for analysis. This view of the lens makes the culture-bound mind considerably more susceptible to change and learning than if information never reaches the higher brain.

Nevertheless, modern neuroscience reveals that the brain-mind is a world all its own, not necessarily reflective of objective reality.

As Dr. Richard L. Gregory of the University of Edinburgh suggests in the November issue of *SCIENTIFIC AMERICAN*: Perception seems to be a matter of reeling back past tapes on objects and how they behave. "The retinal image does little more than select the relevant stored data. This selection is rather like looking up entries in an encyclopedia: behavior is determined by the contents of the entry rather than by the stimulus that provoked the search."