

**Even Old Brains Seem Flexible Enough To Enjoy a Workout by Sharon Begley.
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IF "TRUTH IN LABELING" laws applied to the three pounds of tofu-soft tissue inside your skull, the brain would be in big trouble.

Open any lavishly illustrated brain book to the diagram showing which region of the brain handles which tasks. There are strips that process touch, areas that handle sounds, even clusters of neurons that do math, get jokes and match verbs to nouns. But a growing chorus of researchers is saying, not so fast.

These days, the brain's zoning map -- with different neighborhoods assigned different functions -- is looking as malleable as putty. Evidence of this "plasticity" has been piling up for more than a decade, but now neuroscientists are seeing that it is more radical than they thought, and that it lasts well into adulthood. Yes, you can teach an old brain new tricks.

Take the visual cortex, which turns out to be quite a job hopper. In 1996, scientists using fMRI to peer inside the brains of blind people reading Braille found that the visual cortex processes the sense of touch. This big hunk of neural space (visual regions take up 35% of the brain, and 35% of a brain is a terrible thing to waste) noticed that no signals were arriving from the eyes, and looked around for other employment possibilities. With streams of input arriving from the fingertips, the opportunity was obvious. PEOPLE WHO BECAME blind later in life didn't show this "cross modal" plasticity, suggesting that old brains can't change jobs. But many of those late-blind people lost their sight slowly, to diabetes, for instance. This may be too slow for the visual cortex to notice.

When blindness comes on suddenly, the brain is remarkably nimble even in adulthood. A few years ago Alvaro Pascual-Leone of Harvard Medical School and colleagues blindfolded healthy, sighted adults for a week. Every day, the recruits studied Braille. After mere days, their visual cortex was processing touch.

This job switch happened too quickly to reflect new neuronal connections from, say, the fingers. Instead, those connections must have always been there, Dr. Pascual-Leone suspects, and become "unmasked" only when needed. That suggests that the visual cortex is misnamed. It doesn't see, necessarily, but makes spatial discriminations. "It's easier to do this with vision, but if there is no visual input it can rope in the next-best things, like feeling or hearing," he says. Indeed, in congenitally blind people the visual cortex also localizes sounds, figuring out where a noise came from.

The visual cortex can also become a linguist. Harvard's Amir Amedi and colleagues recently found that people blind from birth seem to use their visual cortex to, of all things, generate verbs when an experimenter says a noun. "Apple" elicits "eat," and "piano" brings "play." But if researchers temporarily knock out the visual cortex with a magnetic pulse, the blind come up with semantic nonsense, such as "sit" for "apple."

The malleability of the brain well into adulthood can be a cause of both concern and optimism. The down side is that artificial vision, using tiny cameras to capture images and send them to the visual cortex, may be a pipe dream. Unless it's done soon after birth, which may not be practical, those images will be landing in a visual cortex that has moved on to other jobs, and the signals will not produce sight.

THE UP SIDE is that old brains are continuing to learn. At last month's annual meeting of the Society for Neuroscience, researchers presented the results of a study in which elderly volunteers, 61 to 94 years old, underwent eight weeks of computer-based training to improve the brain's ability to discriminate the sounds of speech. "In the elderly, there is good evidence that the brain's representation of speech becomes noisier and degraded, which is why some have trouble understanding muffled speech or the speech of young kids," says Michael Merzenich, University of California, San Francisco. "If you have trouble processing fast phonemes, the information fed into memory is crummy." Many dyslexic children have the same speech-processing deficit. Prof. Merzenich and colleagues have shown that retraining the kids' auditory cortex through specially constructed language input improves their reading ability. With similar retraining, the older brains, too, processed speech and remembered things better. "The majority improved 10 or more years in neurocognitive status, so 80-year-olds had the memories of 70-year olds," says Prof. Merzenich. "With more training, I expect we could get it to 25 years."

He foresees a day when the discoveries of neuroplasticity will usher in "a new brain-fitness culture," reflecting "an understanding that you need to exercise your brain as you exercise your body." Crossword puzzles, bridge, reading and other activities aren't enough, though, especially if they've become routine. One of the most robust findings in neuroplasticity is that operating on autopilot doesn't help. Only mental tasks that you focus on intently can produce the physical changes that let old neurons learn new tricks.