



## Brain Plasticity

By: Christie Vosseller

The latest tools of NEUROSCIENCE allow us to witness the electrical flares, CHEMICAL landslides and SLUICING of water from zone to zone that alter the geography of the brain as it changes. Today we are going to learn about how the brain's structure can change when humans learn a new ability.



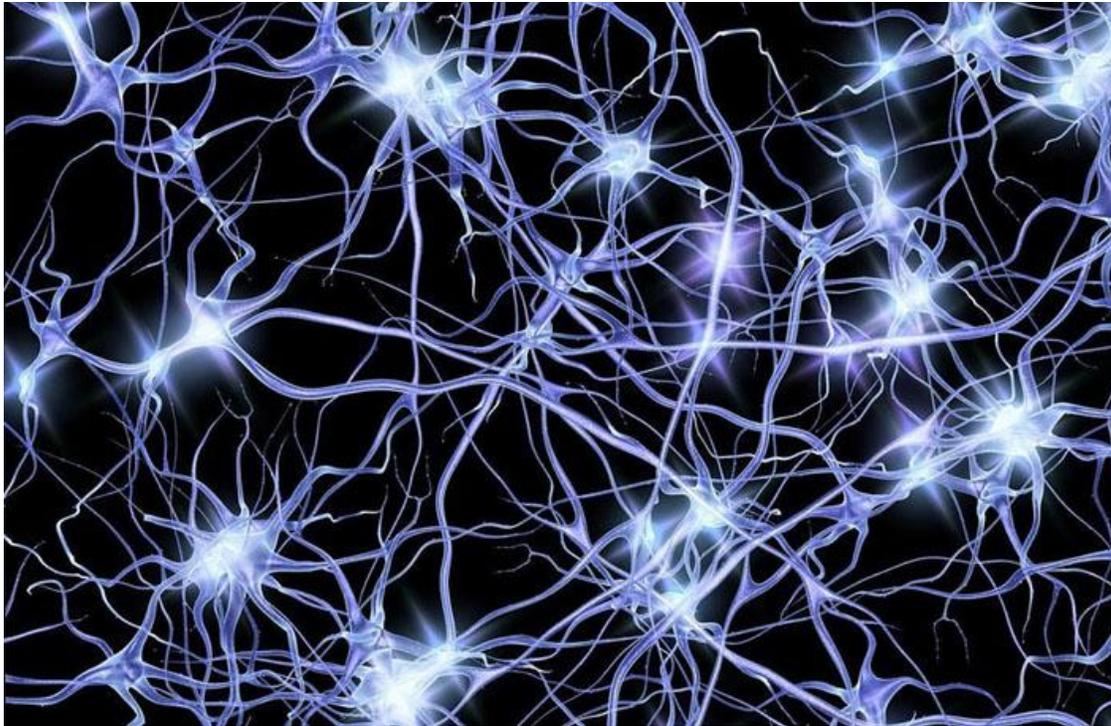
Let's warm up.... Spell WITNESS Spell LEARN Spell STRUCTURE  
Neuroscience allows us to witness electrical what? FLARES  
Neuroscience allows us to witness chemical what? LANDSLIDES  
Both of which are witnessed in what part of our body? BRAIN  
Water sluicing from zone to zone alters what? GEOGRAPHY OF BRAIN  
Today we will learn how the geography or structure changes when what happens? HUMANS LEARN A NEW ABILITY

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Evidence of the ways NEURAL tissue is partially destroyed after a stroke or the onset of DEMENTIA has been around for decades. But proof that missing or miswired human brain connections can grow again—what neuroscientists call PLASTICITY—has so far been lacking. In 2014, a study showed that novel experiences prompt almost immediate changes in white matter—the brain’s connective tissue, or highway system, in the brains of mice.



Evidence of ways brain tissue is destroyed is offered by what patients?

STROKE DEMENTIA

Proof of what has been lacking? PLASTICITY

What is plasticity? MISSING OR MISWIRED HUMAN BRAIN CONNECTIONS GROW AGAIN

In mice, what matter changes with novel experiences? WHITE MATTER

What is white matter? BRAINS CONNECTIVE TISSUE OR HIGHWAY

In what year was the study with mice published? 2014

How many years ago was that? CURRENT YEAR – 2014 =

Can this structural transformation linked to learning a new skill be seen in humans too? The answer appears to be yes. A study just published in the journal NATURE

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COMMUNICATIONS found distinct shifts in brain architecture that mirrored the growing reading skills of children with DYSLEXIA. “The way the connections between different brain regions had changed was startling,” said JASON YEATMAN, an assistant professor at the University of Washington who led the study.

What journal published the new study? NATURE COMMUNICATIONS

Researchers found distinct shifts in what? BRAIN ARCHITECTURE

What skill did it mirror in this study? GROWING READING SKILLS

Children in this study had what learning disability? DYSLEXIA

What is the name of the researcher? JASON YEATMAN

Where is he a professor? UNIVERSITY OF WASHINGTON

Dr. Yeatman’s team began by recruiting 24 dyslexic children, ages 7 and 12, who had been struggling to learn to read. Few of them could DECIPHER more than simple three-letter words. This largely excluded them from the classroom experience, said Dr. Yeatman.

How many children participated in the study? 24

What was the age range? 7 YEARS TO 12 YEARS OLD

What had they been struggling to do? LEARN TO READ

What experience did this exclude them from? CLASSROOM

The researchers thoroughly tested the children’s reading skills and assessed their brain ARCHITECTURE using diffusion magnetic resonance imaging, or MRI. This noninvasive type of brain imaging tracks how quickly water flows among regions of the brain. It provides a measure of brain density, which increases with the formation of new brain cells, connections and MEMBRANES.

What does MRI stand for? MAGNETIC RESONANCE IMAGING

MRI tracks how quickly... WATER FLOWS AMONG REGIONS OF BRAIN

MRI provides a measure of what? BRAIN DENSITY

Brain density increases with formation of what? NEW BRAIN CELLS  
CONNECTIONS AND MEMBRANES

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The children’s initial MRI was followed by three subsequent imaging sessions, evenly spaced over the course of their participation in an intensive, eight-week summer reading program. The program provided one-on-one instruction for four hours a day, five days a week. Unlike much recent research on children’s learning, the instruction was in person, not screen-based.

- How long was the summer reading course? EIGHT WEEKS
- How many MRI’s followed the initial visit? 3 MRI’S
- How many days a week did the students receive instruction? 5
- How many hours a day? FOUR
- How many hours of instruction is that a week?  $5 \times 4 = 20$  HOURS
- Instruction was in person, not what? SCREEN BASED

The results showed significant improvement in reading skills—and as the children’s reading FLUENCY increased, large tracts of the white matter in their brains were visibly REVAMPED (improved). “It was not known before that the physical structure and EFFICIENCY of the brain could change in just a few weeks,” said Dr. Yeatman.

- Outwardly, children showed an improvement in what? READING SKILLS
- As fluency increased, what revamped in brain? WHITE MATTER
- The physical structure and efficiency changed in how long? JUST A FEW WEEKS; QUICKLY; FAST

The instructional approach was, by design, highly individualized and interpersonal. LINDAMOOD-BELL targets the building blocks of reading and is intended to give children with dyslexia the tools they need to read. But it is just one of several evidence-based, effective approaches.

- What was the name of the instructional approach? LINDAMOOD BELL
- It was highly individualized and what? INTERPERSONAL
- Lindamood Bell targets what? BUILDING BLOCKS OF READING

Another surprising observation was that the RENOVATION (rebuilding; change) of the brain was so PERVASIVE (widespread). The researchers expected the observed improvement in the brain’s language areas. “But we also saw changes in the

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CORTICOSPINAL tract,” which allows SENSATION (feeling or perception) and MOVEMENT to be sensed by the brain, Dr. Yeatman added.

They characterize renovation of brain as what? PERVASIVE

What did they expect to observe? IMPROVEMENT IN BRAINS LANGUAGE AREAS

What does renovation mean? REBUILDING; CHANGE

What tract also changed? CORTICOSPINAL

This tract allows what to be sensed? SENSATION AND MOVEMENT

Perhaps the bond between teacher and child or the frequency and intensity of the teaching program made the difference. It’s hard to pinpoint the cause—or to know how long the NEURAL and behavioral changes will last. But the changes were still impressive.

“We knew it was possible for the brain to change in mice, but we didn’t know the time frame, and we didn’t know how extensive the remodeling was in humans,” said Dr. Yeatman. Now we know that education can physically alter the brains of mice and men—or, more importantly, boys and girls.

What bond may make the difference? TEACHER AND CHILD

What about the teaching program may have made a difference? FREQUENCY AND INTENSITY

Scientists knew they could make changes in the brains of mice, but were not sure about \_\_\_\_\_? HUMANS

The word neural is associated with the \_\_\_\_\_? BRAIN

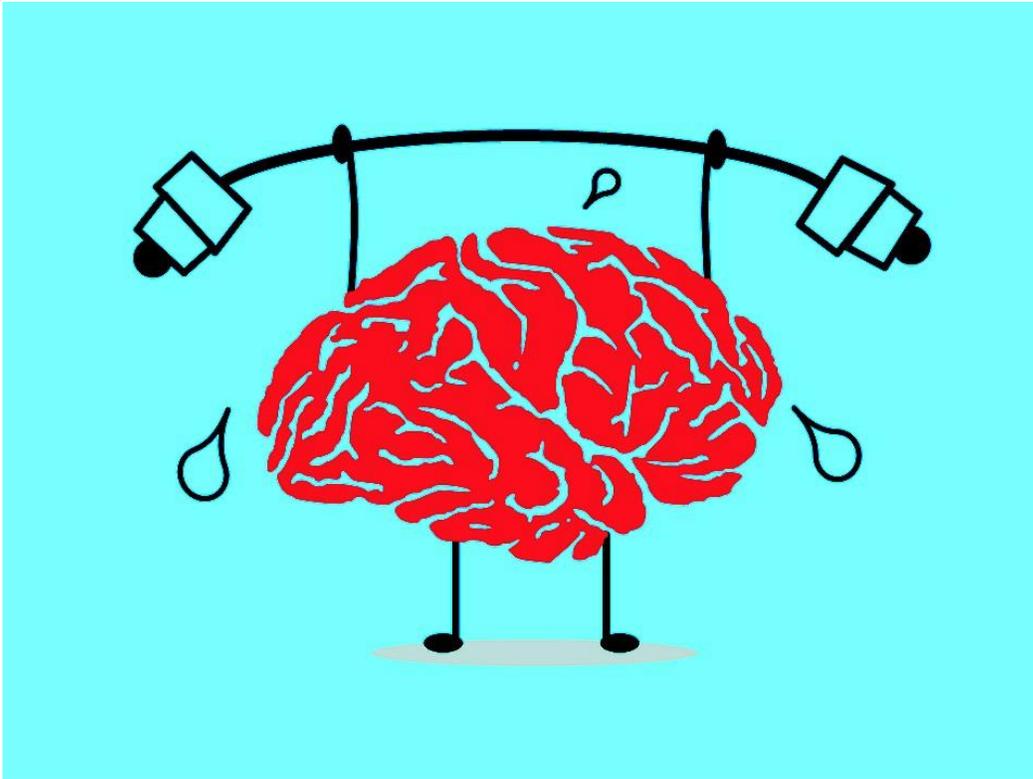
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Creative writing:

As you add new skills – do you believe your brain actually, physically grows? Tell me what you think!

This research suggests that as language was improved, and senses may have been heightened. Do you experience heightened senses when you master a new task?



Christie Vosseller is not a practitioner but IS an ally of the nonspeaking community and a great lesson writer. She works in Human Resources and enjoys traveling with her wife, Elizabeth and taking long walks with her papillons puppies, Jacques and Henri.

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### Sources:

Pinker, Susan. (June 14, 2018). New Skills Build New Brain Architecture. The Wall Street Journal. Retrieved on July 16, 2018 from: <https://www.wsj.com/articles/new-skills-build-new-brain-architecture-research-shows-1528993660>

*The mission of I-ASC is to advance communication access for nonspeaking individuals globally through training, education, advocacy and research. I-ASC supports all forms of augmentative and alternative communication (AAC) with a focus on methods of spelling and typing. I-ASC currently offers Practitioner training in Spelling to Communicate (S2C) with the hope that other methods of AAC using spelling or typing will join our association.*

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