- Brain

SCIENCE

CAN THE BRAIN REWIRE ITSELF?

Your brain needs to adapt and change throughout your life

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Your brain reaches its full size by early adolescence and fully matures by around the age of 25. But did you know that your brain will continue to change forever, moulding itself around your physical condition, emotional experiences and daily activities? The constant adaptation to good and bad events, and the trillions of signals firing in your brain every day, is called neuroplasticity.

Thanks to studies into the brain using magnetic resonance imaging (MRI) scanners to study neural activity, scientists now know that the brain's function isn't fixed. Every thought, sensation and emotion felt is the work of the brain's 86 billion neurons. These neurons pass signals between each other to spread information to core processing regions of the brain. These signals can travel at 300 miles per hour, releasing chemicals between the cells to establish pathways. These are like chemical memories, forming pathways that work more efficiently the more information is passed through them. However, just as these pathways are built up and strengthened, they can also be weakened and other routes prioritised.

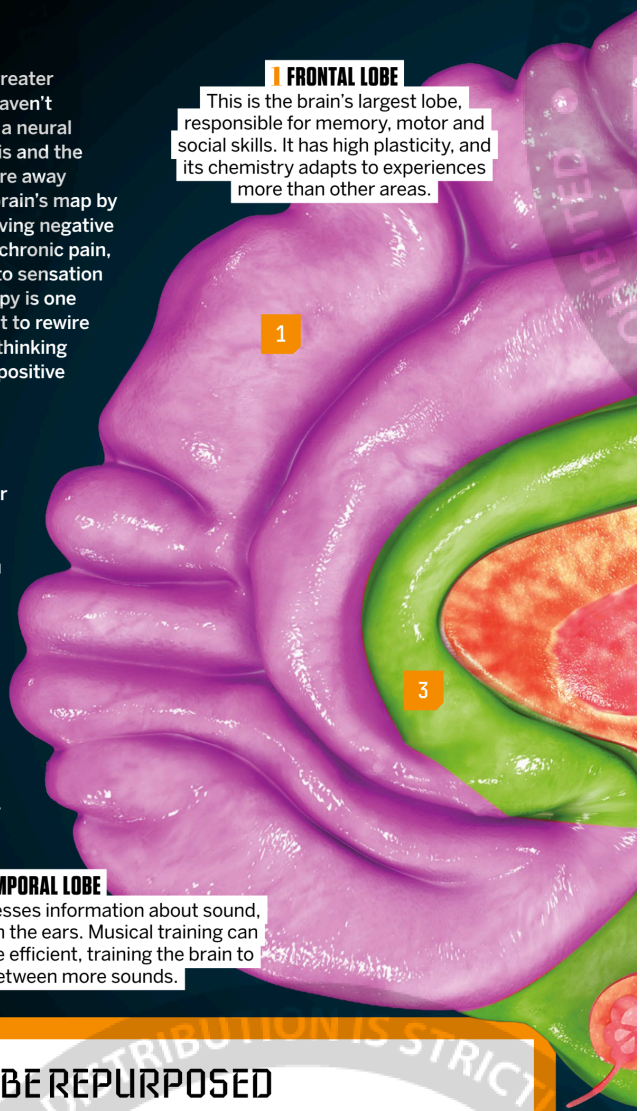
When you engage in a new activity or skill, you form new neural pathways. These pathways are weak to begin with, but you can build up their strength through repetition.

Did you know?

You have over 6,000 thoughts a day on average

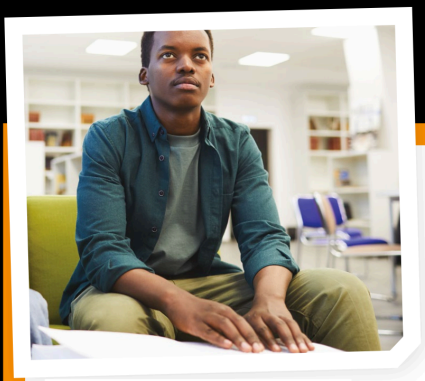
Younger people generally have greater neuroplasticity, as their brains haven't changed as much yet. The more a neural pathway is used, the stronger it is and the harder it is for your brain to rewire away from it. You can also alter your brain's map by weakening pathways that are having negative reactions. For example, when in chronic pain, your brain may be overreacting to sensation signals. Pain-reprocessing therapy is one way in which sufferers attempt to rewire the brain by consciously thinking of the sensations in a positive way to prevent this overinterpretation.

The brain impacts every action in the body, so it uses 20 per cent of the body's total energy requirements to function. The more stressed you are, the less available energy there is that can be used to shape and reshape your brain effectively. Continuing to learn new things throughout your lifetime is one of the best ways to improve and maintain cognitive health, keeping your neural connections evolving and choosing the healthiest ways for your brain's complex circuitry to wire and rewire.



1 FRONTAL LOBE
This is the brain's largest lobe, responsible for memory, motor and social skills. It has high plasticity, and its chemistry adapts to experiences more than other areas.

3 TEMPORAL LOBE
The temporal lobe processes information about sound, interpreting signals from the ears. Musical training can make this analysis more efficient, training the brain to differentiate between more sounds.



In the brain of a blind person, the neural connections for touch will be stronger than those for sight, as they rely on these sensations for activities like reading braille

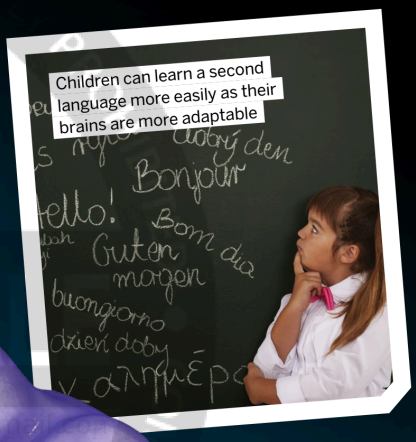
REGIONS CAN'T BE REPURPOSED

Some scientists have concluded that the brain's neuroplasticity is so advanced it can repurpose and rewire its regions outside of their original roles. For example, someone who loses their sight could use the vision-processing region of the brain – the visual cortex – to process different senses. But others disagree. Researcher Tamar Makin carried out a study in 2022 to assess the claim that nerve signals from an amputated finger can be reallocated to the remaining fingers. By using nerve blockers in one finger, she analysed the signals responsible for sensing touch in that finger in the brain. When the nerve was no longer working, the brain region didn't contribute to other nerves. Instead, the signals allocated to the remaining nerves increased in strength. Makin argued that brains don't repurpose their regions, but the remaining senses are heightened to accommodate the loss through repetition and signal strengthening.

DID YOU KNOW? Until the 1960s, scientists thought the brain's structure was permanent after childhood

PLASTICITY OF PARTS

How much can each region of the brain be altered?



2 PARIETAL LOBE
This lobe processes sensory information and language processing. Bilingual speakers build more grey matter in this area, which has more neurons than white matter.

4 OCCIPITAL LOBE
Visual information is processed by brain cells in this area. This lobe is still active in blind people when other senses are used, suggesting a rewiring of the brain.

5 CEREBELLUM
The cerebellum controls balance and muscle movement. Its signals can change to improve movements, making them more precise with relevant practice.

6 BRAIN STEM
The brain stem's nervous tissue regulates reflex actions like breathing, blood pressure and consciousness. In reflex plasticity, neural pathways change to bypass damaged areas and retain vital responses.

5 FACTS WAYS THE BRAIN CHANGES

1 LEARNING NEW SKILLS
As you learn, new neural connections are made in the brain. Everything you learn begins as a short-term memory and is transferred to long-term memory as neural connections become stronger.

2 BRAIN INJURY RECOVERY
When you suffer a significant head injury, memory training can change neural pathways in the brain to enhance cognitive function. These rely on other areas that still function.

3 EXERCISING THE BRAIN
When you perform physical exercise, a protein that promotes neural growth, called brain-derived neurotrophic factor (BNNF), is released. This improves cognitive function and connectivity in the brain.

4 FORMING HABITS
The repetition of habits produces automatic neural connections in the brain. The area of the brain called the basal ganglia is responsible for subconscious habits. As neural pathways become more efficient, habits are harder to break.

5 COGNITIVE BEHAVIOURAL THERAPY
This form of therapy is an active way to change neural pathways in the brain. By changing habitual behaviours for new, healthier ones, different connections become stronger and alter thought patterns to avoid negative emotions.