Medical Xpress

The middle-aged brain changes a lot—and it's key to understanding dementia

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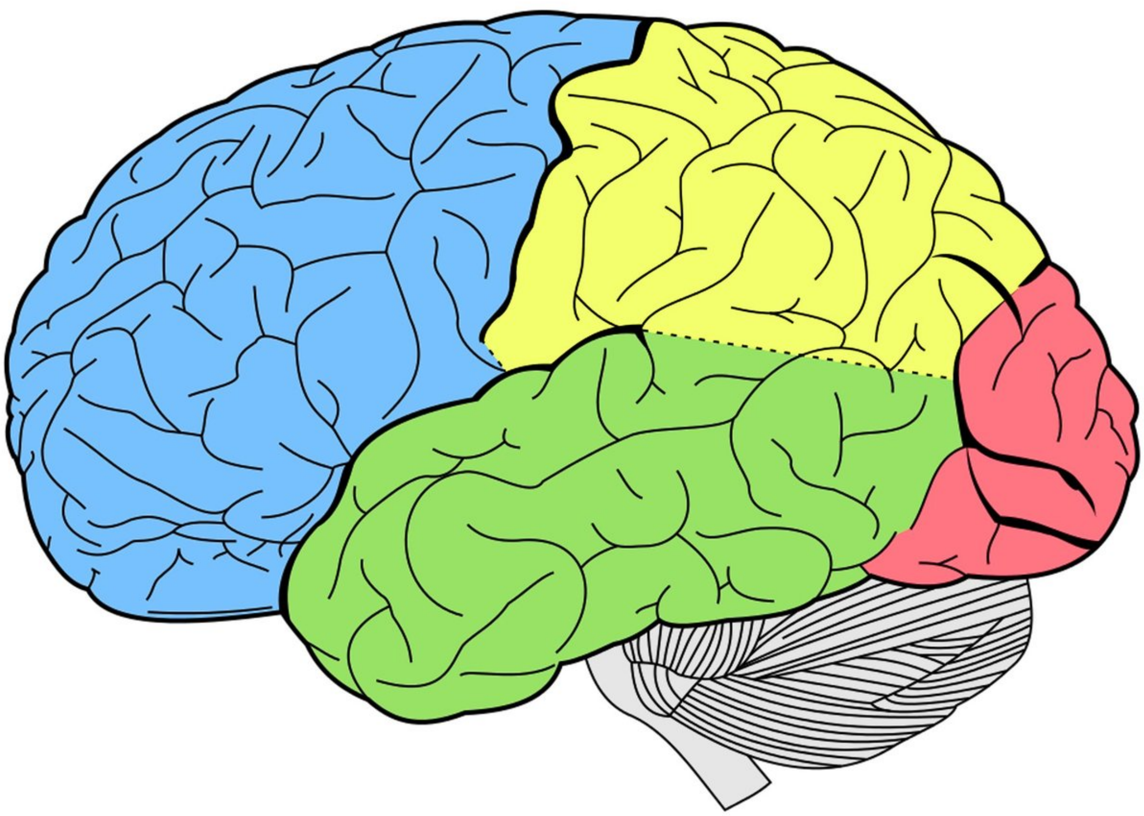

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Our brains change more rapidly at various times of our lives, as though life's clock was ticking faster than usual. Childhood, adolescence and very old age are good examples of this. Yet for much of adulthood, the same clock seems to tick fairly regularly. One lap around the sun; one year older.

However, there may be a stage of life when the brain's clock starts speeding up. The brain starts changing without you necessarily noticing it. It may even be caused (partly) by what's in your blood. This stage of brain aging during your 40s to 50s, or "middle-aging", may predict your future health.

Psychologists studying how our mental faculties change with age find that they decline gradually, starting in our 20s and 30s. However, when assessing people's memory of everyday events, the change over time appears to be especially rapid and unstable during middle age. That is, even among healthy people, some experience rapidly deteriorating memory, while for others, it may even improve.

This suggests that the brain may be going through accelerating, as opposed to gradual, change during this period. Several structures of the brain have been found to change in midlife. The hippocampus, an area critical for forming new memories, is one of them.

It shrinks throughout much of adulthood, and this shrinkage seems to accelerate around the time of middle age. Abrupt shifts in the size and function of the hippocampus during middle age could underlie memory changes like the ones mentioned above.

Ultimately, what allows the brain to carry out its functions are the connections between brain cells—the white matter. These connections mature slowly throughout adulthood, especially the ones connecting areas of the brain that deal with cognitive functions such as memory, reasoning and language.

Interestingly, during middle age, many of them go through a turning point, from gaining volume to losing volume. This means that signals and information cannot be transmitted as fast. Reaction time starts deteriorating around the same time.

Through the white matter connections, brain areas talk to each other and form interconnected networks that can perform cognitive and sensory functions, including memory or vision. While the sensory networks deteriorate gradually throughout adulthood, the cognitive networks start deteriorating faster during middle age, especially those involved in memory.

Much like how highly connected people in society tend to form cliques with each other, brain regions do the same through their connections. This organization of the brain's communication allows us to perform some of the complex tasks we might take for granted, such as planning our days and making decisions.

The brain seems to peak in this regard by the time we hit middle age. Some have even referred to middle age as a "sweet spot" for some types of decision-making, but then the network "cliques" start to break up.

It's worth stating at this point why these subtle changes matter. The global population aged 60 and over is set to roughly double by 2050, and with this, unfortunately, will come a considerable increase in dementia case numbers.

Focus has been too much on the brain in old age

Science has long focused on very old age, when the detrimental effects of time are most obvious, but, by then, it can often be too late to intervene. Middle age could be a period when we can detect early risk factors of future cognitive decline, such as in dementia. Critically, the window of opportunity to intervene may also still be open.

So, how do we detect changes without having to give everyone an expensive brain scan? As it turns out, the contents of blood may cause the brain to age. With time, our cells and organs slowly deteriorate, and the immune system can react to this by starting the process of inflammation. Inflammatory molecules can then end up in the bloodstream, make their way to the brain, interfere with its normal functioning and possibly impair cognition.

In a fascinating study, scientists from Johns Hopkins and the University of Mississippi analyzed the presence of inflammatory molecules in the blood of middle-aged adults and were able to predict future cognitive change 20 years down the line. This highlights an important emerging idea: age in terms of biological measures is more informative about your future health than age in terms of years lived.

Importantly, biological age can often be estimated with readily available and cost-effective tests used in the clinic.

"Middle aging" may be more consequential for our future brain health than we think. The hurried ticking of the clock could be slowed from outside the brain. For example, physical exercise confers some of its beneficial effects on the brain through blood-borne messengers. These can work to oppose the effects of time. If they could be harnessed, they might steady the pendulum.

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