

## The mind at midlife

Longstanding beliefs say the adult brain is best in its youth, but research now suggests otherwise. The middle-aged mind preserves many of its youthful skills and even develops some new strengths.

By Melissa Lee Phillips

Ask those who've entered the thick of middle age what they think about their mental capacities and you're likely to hear a slew of complaints — their brains don't work as quickly as they used to, they're distractable and unfocused, and they can never remember anyone's name.

While some of these complaints reflect real declines in brain function in our middle years, the deficiencies of a middle-aged brain have likely been overstated by anecdotal evidence and even by some scientific studies.

Contrary to its reputation as a slower, duller version of a youthful brain, it seems that the middle-aged mind not only maintains many of the abilities of youth but actually acquires some new ones. The adult brain seems to be capable of rewiring itself well into middle age, incorporating decades of experiences and behaviors. Research suggests, for example, the middle-aged mind is calmer, less neurotic and better able to sort through social situations. Some middle-agers even have improved cognitive abilities.

"There is an enduring potential for plasticity, reorganization and preservation of capacities," says cognitive neuroscientist Patricia Reuter-Lorenz, PhD, of the University of Michigan in Ann Arbor.

Researchers now have an unprecedented wealth of data on the aging brain from the Seattle Longitudinal Study, which has tracked the cognitive abilities of thousands of adults over the past 50 years. These results show that middle-aged adults perform better on four out of six cognitive tests than those same individuals did as young adults, says study leader Sherry Willis, PhD, of the University of Washington in Seattle.

While memorization skills and perceptual speed both start to decline in young adulthood, verbal abilities, spatial reasoning, simple math abilities and abstract reasoning skills all improve in middle age.

Cognitive skills in the aging brain have also been studied extensively in pilots and air-traffic controllers. Again, older pilots show declines in processing speed and memory capacity, but their overall performance seems to remain intact. In a study published in *Neurology* (Vol. 68, No. 9) in 2007, researchers tested pilots age 40 to 69 as they performed on flight simulators. Older pilots took longer to learn to use the simulators but did a better job than their younger colleagues at achieving their objective: avoiding collisions.

Many middle-aged people are convinced that they're just not as mentally skilled or even as intelligent as they used to be, Willis says. But it's possible that's an illusion arising from the aspects of cognition that do suffer in middle age.

"They may get the sense they're cognitively slow just because they're perceptually slow or slow with psychomotor skills," she says, when in reality their brains are performing most tasks remarkably well. Changing strategies

Researchers used to believe that brain activity would slow down with aging so that older brains would show less activity overall than younger ones. But functional neuroimaging studies have overturned that assumption.

For example, psychologist Cheryl Grady, PhD, of the University of Toronto, and her colleagues have found that older adults use more of their brains than young adults to accomplish certain tasks. In a study published in the *Journal of Neuroscience* (Vol. 3, No. 2) in 1994, Grady reported that performing a face-matching task activates mainly the occipital visual areas in younger adults, but older adults use these areas as well as the prefrontal cortex. (Both groups of adults are equally skilled at the task.)

Several groups, including Grady's, have also found that older adults tend to use both brain hemispheres for tasks that only activate one hemisphere in younger adults. Younger adults show similar lateralization of brain activity if the task is difficult enough, Reuter-Lorenz says, but older adults use both hemispheres at lower levels of difficulty.

The strategy seems to work. According to work published in *Neuroimage* (Vol. 17, No. 3) in 2002, the best-performing older adults are the most likely to show this lateralization. Older adults who continue to use only one hemisphere don't perform as well.

Reuter-Lorenz finds these changes with age encouraging, as they show that the middle-aged brain is capable of altering how it does things in order to accomplish the task at hand. "Compensation through some brain mechanisms may make up for losses in others," she says.

Grady cautions that many studies on the middle-aged brain are preliminary, as this age group "hasn't been studied very much. It certainly hasn't been studied enough." Most functional imaging studies, for example, tend to recruit college students and retirees as study subjects, Grady says. Cognitive characteristics of in-between ages are often simply extrapolated from the two ends of the spectrum.

While a linear continuum may be accurate for many traits, it may not always be a valid assumption. Grady's own work on brain activation during memory tasks, for example, suggests that the middle-aged pattern does fall between those of a young adult and an elderly person.

For example, the amount of white matter in the brain, which forms the connections among nerve cells, seems to increase until age 40 or 50 and then falls off again. "So that suggests that there are some developmental changes that really don't hit their peak until somewhere in middle age," Grady says.

At least the glasses are rose-colored

Emotions and social interactions — even personality — may systematically change as people enter middle age. Many studies have found that people become calmer and less neurotic as they age. "There's a quieting of emotional storms," Reuter-Lorenz says.

Work by cognitive psychologist Mara Mather, PhD, of the University of Southern California in Los Angeles, has found that older adults tend to focus more on positive information and less on negative information than their younger counterparts. In 2004, she and her colleagues reported in *Psychological Science* (Vol. 15, No. 4) that the amygdala in older adults actually responds less to negative stimuli (such as unpleasant pictures) than it does in young adults. Starting around age 40, people also show a better memory for positive images than for negative ones, and this trend continues until at least age 80.

This "positivity effect" is seen even more strongly in people who are doing exceptionally well cognitively, Mather says, "so it doesn't seem to be something that just goes along with cognitive decline; it seems to be something that's an active process."

These findings fit with many self-reports from middle-aged and older individuals, Mather says. Older adults rank emotional stability and positive affect as more important than younger adults do, and they say that they're better at regulating their own emotions than they were in their youth.

Although scientifically analyzing such qualities as judgment and wisdom is considerably more difficult than measuring psychomotor speed or memory storage capacity, some researchers are trying to do just that. Research over the past several years has reported that middle-aged people are much more expert at many social interactions — such as judging the true intentions of other human beings — than are those either younger or older.

And work by David Laibson, PhD, at Harvard University, found that adults in midlife show better economic understanding and make better financial decisions than either younger or older adults. In fact, the average person's financial judgment seems to peak at 53.

## Variability and influences

One of the middle-aged mind's most striking features may not be any one feature or ability, but rather the variation in cognitive skills that's found in this age group. Although differences in cognition obviously exist among individuals at all ages, these differences seem to increase in middle age.

For example, memory and attention frequently suffer in middle age, but some individuals' abilities actually improve in midlife. In Willis's Seattle study, most participants' ability to remember lists of words declined in middle age, but about 15 percent performed better on this task than they did as young adults.

"If you study a wide range of abilities, you begin to realize how very complex cognitive decline is and how many individual differences there are," Willis says.

This variation in behavioral performance is also reflected in expression of genes related to learning and memory. In a study published in *Nature* in 2004 (Vol. 429, No. 6,994), the brains of adults under age 40 consistently showed little damage and high levels of expression of these genes, while brains from those over 73 showed lots of damage and low gene expression. But in the middle-aged group, results varied widely. Some middle-aged brains were already shutting down, whereas others were indistinguishable from a 30-year-old brain.

"It's a very interesting and heterogeneous group," Grady says.

With more study of middle age in general — especially of those who seem to glide through those years with cognitive abilities intact or even improving — scientists hope to enable many more people to preserve cognitive health into old age.

So far, research suggests that remaining cognitively impressive with age comes from adopting certain behaviors as well as possessing some genetic luck, Willis says. For example, researchers have identified several gene variants that are risk factors for early memory problems. But people who show cognitive improvement in midlife also tend to be more physically, cognitively and socially active than those who don't fare as well.

"Instead of a crisis, middle age should be thought of as a time for a new form of self-investment," Reuter-Lorenz says. "This time of life brings so many new opportunities to invest in your own cognitive and physical resources, so you can buffer against the effects of older age."