

Scientists mapped what pregnancy really does to a mom's brain

The research shows how pregnancy remodels the brain in unprecedented detail and opens a new window into matrescence -- the transition to becoming a mother.

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By [Carolyn Y. Johnson](#)

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Scientists have captured one woman's cognitive evolution into motherhood, taking repeated brain scans over three years to reveal the most detailed picture yet of the dynamic brain changes that unfold over the course of pregnancy.

The emerging evidence suggests that "[mommy brain](#)" could be a real thing, but nothing like the pop culture conception of young mothers becoming cognitively fuzzy and absent-minded. Instead, neuroscientists are just beginning to document how hormones drive an intricate, choreographed set of changes that may prepare and hone the brain for parenting.

When neuroscientist Liz Chrastil and her husband were ready to start her family, she couldn't pass up the opportunity to study herself. With a team of collaborators who have also studied the brain during menopause and the menstrual cycle, she slid into the scanner 26 times — before, during and after her pregnancy — providing an unprecedented view of a transformative event in human biology that has long been [overlooked by science](#).

Key areas in her cortex, the wrinkly outer layer of her brain, shrank and thinned and remained that way long-term, while the superhighways that connect brain regions improved during pregnancy, then returned to baseline after her son was born. The proof-of-concept experiment, published Monday in the journal [Nature Neuroscience](#), revealed how malleable Chrastil's brain was on a month-by-month basis.

The experience of becoming a mother affects a person's "biology, cognition, her sense of self and place in society — and even her risk of brain decline in late life," Sharna Jamadar, a neuroscientist at Monash University in Australia who was not involved in the study, said in an email. "Despite these massive changes that occur during pregnancy, we have a largely poor understanding of exactly what changes occur in the brain during this time."

An expanded project to scan the brains of more expectant mothers has already kicked off, to test how universal these changes are and to help unravel the deeper question of how changes in brain structure influence behavior or thinking. The hope is that such studies could ultimately identify clues as to why some women develop postpartum depression or elucidate how pregnancy sets the brain up for aging.

‘Mommy brain’ isn’t what you think it is

Pregnancy is a linchpin of human existence, but the maternal brain has been understudied and underappreciated. Most of what researchers know about it come from snapshots taken before and after pregnancy.

The new study aligned well with what was known from that research. There was a widespread and long-lasting reduction in the volume of gray matter, where brain cells are concentrated and thoughts, sensations and memories are rooted. Those changes stuck two years after Chrastil’s son was born, and similar changes have been documented to persist long-term in other studies.

But because this team looked at the brain during pregnancy itself, they saw something new: The integrity of the connections between brain regions — the white matter — strengthened during the first and second trimester, then reverted back after birth.

A shrinking brain may sound like it can’t possibly be a good thing, but Susana Carmona, a neuroscientist at Gregorio Marañón General University Hospital in Madrid who was not involved in the study, has found that the decrease in gray matter volume over pregnancy may be linked to increased levels of maternal attachment, suggesting that the brain is adapting for the challenge ahead.

Emily Jacobs, a neuroscientist at the University of California at Santa Barbara and one of the leaders of the study, compares this process to Michelangelo’s masterpiece, “David.”

“You start off with this chunk of marble, and you chip away — that pruning can reveal the underlying beauty,” Jacobs said.

Chrastil said that she didn’t experience “mom brain,” even though she has the rare ability to quantify with precision exactly how much her gray matter shrank — about 4 percent. She pointed out that most new mothers are sleep deprived, which could play a role in how well people feel their brains are working.

Margaret McCarthy, a neuroendocrinologist at the University of Maryland School of Medicine, said that based on what’s known about other animals’ brains during pregnancy, the changes probably represent a refinement and not a loss. In mice, hormones trigger the remodeling of brain circuits that make them responsive to pups, for example.

“We know from the animal research that the hormonal milieu of pregnancy changes the brain to prepare it for motherhood,” McCarthy said.

The ever-evolving brain

The new work is part of a wave of studies that demonstrate just how fluid the brain is — what neuroscientists call “plasticity.”

It’s easy to conceptualize the brain as a static organ, but research has shown that its ability to change and adapt is key to its function. During adolescence, brain cells are pruned in a process that improves its efficiency. But even in adulthood, and even on short time scales, the brain changes.

One of the leaders of the new study, Laura Pritschet, a postdoctoral fellow in psychiatry at the University of Pennsylvania Perelman School of Medicine, put herself in the scanner every day for a month during her menstrual cycle, revealing that brain networks are reshaped over the course of a month.

And it’s not just women. First-time fathers’ brains also remodeled after the birth of their child, researchers have found. Sex hormones also fluctuate over the course of a day, and when researchers scanned a man’s brain at 7 a.m. and 8 p.m. over the course of a month, they also found evidence of rhythmic changes in brain connectivity.

Still, there’s something especially interesting going on during pregnancy, where the magnitude of change over a short time period is especially dramatic.

“All in all, this supports the reconceptualization of motherhood as one of the periods of highest neuroplasticity in adult life,” Carmona said.

