

After a stroke in an infant's brain, the right side of the brain compensates for loss of language in the left side

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A clinical study conducted by researchers at Georgetown University Medical Center has found that for children who had a major stroke to

the left hemisphere of their brain within days of their birth, the infant's brain was "plastic" enough for the right hemisphere to acquire the language abilities ordinarily handled by the left side, while also maintaining its own language abilities.

The left [hemisphere](#) of the [brain](#) is normally responsible for sentence processing (understanding words and sentences as we listen to speech). The [right hemisphere](#) of the brain is normally responsible for processing the emotion of the voice—whether it is happy or sad, angry or calm. This study sought to answer the question "What happens when one of the hemispheres is injured at birth?"

The findings appear in *PNAS* the week of October 10, 2022.

The participants in this study developed normally during pregnancy. But around birth they each had a significant [stroke](#), one that would produce debilitating outcomes in adults. In [infants](#), a stroke is much rarer, but does happen in roughly one out of every four thousand births.

The researchers studied perinatal arterial ischemic stroke, a type of brain injury occurring around the time of birth in which blood flow to a part of the brain is cut off by a blood clot. The same type of stroke occurs much more commonly in adults. Previous studies of brain injury in infants have included several types of brain injury, but the focus in this study on a specific type of injury enabled the authors to find more consistent effects than in previous work.

"Our most important conclusion is that plasticity in the brain, specifically the ability to reorganize language to the opposite side of the brain, is definitely possible early in life," says Elissa Newport, Ph.D., director of the Center for Brain Plasticity and Recovery at Georgetown Medical Center, professor in the departments of Neurology and Rehabilitation Medicine and first author of this study.

"However, this early plasticity for language is restricted to one brain region. The brain is not able to reorganize injured functions just anywhere, as more dramatic reorganization is not possible even in [early life](#). This gives us great insights into the regions we might be able to focus on for potential breakthroughs in developing techniques for recovery in adults as well."

The investigators recruited people from across the United States who all had medium to large strokes to the cortex region of their left hemisphere around the time of birth. To assess long-term outcomes in their [language abilities](#), participants were given language tests at 9 to 26 years of age and were compared to their close-in-age healthy siblings. They were also scanned in an MRI to reveal which brain areas were involved in sentence comprehension.

The participants and their healthy siblings all completed the language tasks almost perfectly. The major difference was that the stroke participants processed sentences on the right side of the brain while their siblings processed sentences on the left side. The stroke participants showed a very consistent pattern of language activation in the right hemisphere, regardless of the extent or location of damage from the stroke to the left hemisphere. Only one of the 15 participants, who had the smallest stroke, did not show clear right hemisphere dominant activation.

"It is also notable that many years after their strokes, our participants are all such highly functioning adults. Some are honor students and others are working toward or have gotten their master's degrees," says Newport. "Their achievements are remarkable, especially since some of their parents had been told when they were born that their strokes would produce life-long impairments."

In future studies the researchers hope to gain a better understanding of

why the left hemisphere routinely becomes dominant in healthy brains but consistently loses out to the right hemisphere when there is a significant left-hemisphere stroke. An additional question of special interest—and clinical importance—is why left hemisphere language can successfully reorganize to the right hemisphere if injuries occur very early in life but not later. Research on stroke recovery and sentence processing in adults suggests that plasticity narrows with age, something that Newport hopes to study as it could be of great benefit, and potential therapeutic interest, to adult stroke survivors.

More information: Newport, Elissa L., Language and developmental plasticity after perinatal stroke, *Proceedings of the National Academy of Sciences* (2022). [DOI: 10.1073/pnas.2207293119](https://doi.org/10.1073/pnas.2207293119).
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