Medical Xpress

Gender identity leaves imprint on human brains, neuroscience researchers find

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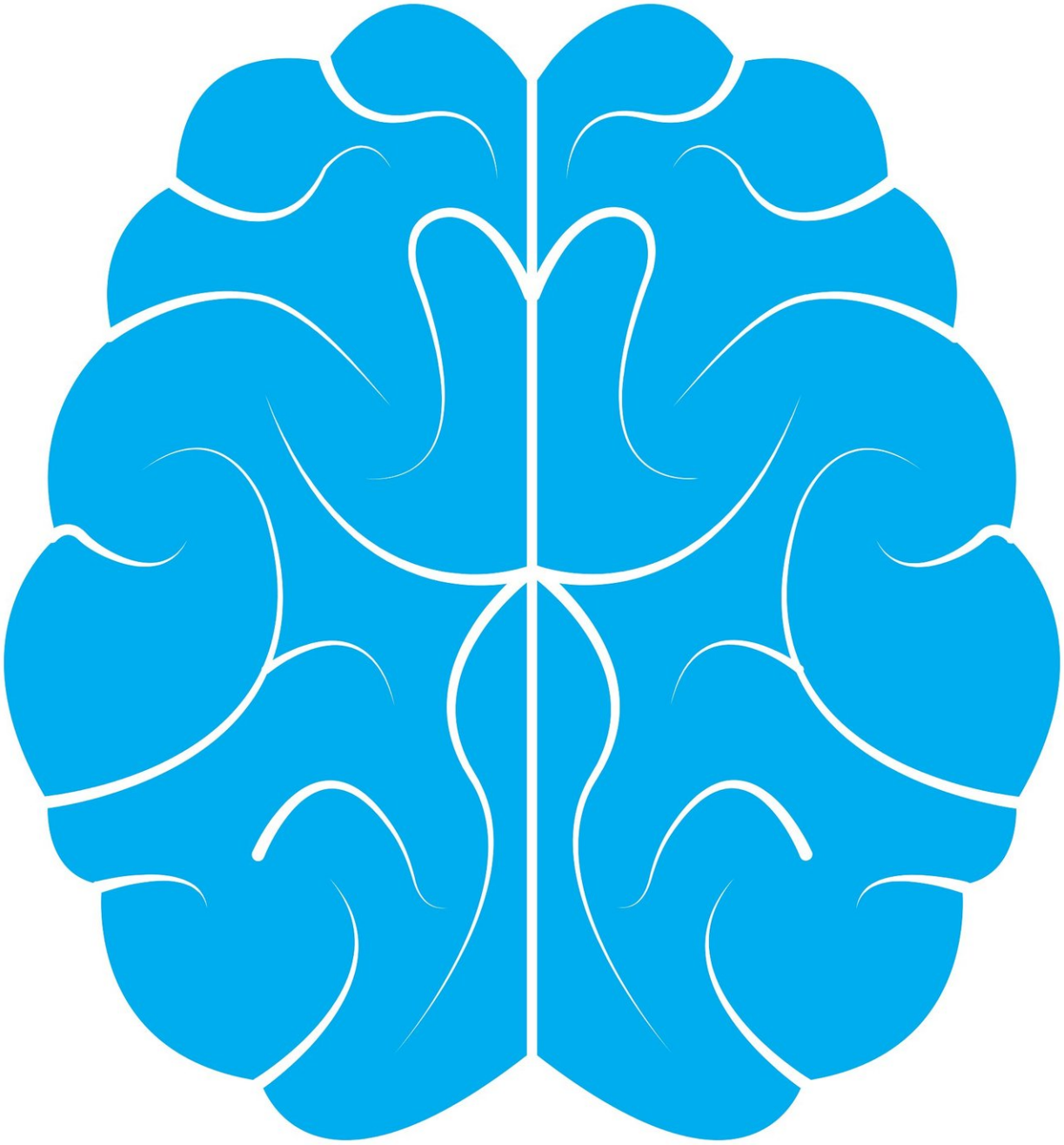

Society's expectations about gender roles alter the human brain at the cellular level, according to a paper published by a group of neuroscience researchers at Georgia State University.

"We are just starting to understand and study the ways in which gender identity, rather than sex, may cause the brain to differ in males and females," said Nancy Forger, professor and director of the Neuroscience Institute.

Though the terms 'sex' and 'gender' are often used interchangeably by the average person, for neuroscientists, they mean different things, Forger said.

"Sex is based on biological factors such as sex chromosomes and gonads [reproductive organs]," she said, "whereas gender has a social component and involves expectations and behaviors based on an individual's perceived sex."

These behaviors and expectations around gender identity can be seen in "epigenetic marks" in the brain, which drive biological functions and features as diverse as memory, development and disease susceptibility. Forger explained that epigenetic marks help determine which genes are expressed and are sometimes passed on from cell to cell as they divide. They also can be passed down from one generation to the next, she said.

"While we are accustomed to thinking about differences between the brains of males and females, we are much less used to thinking about the

biological implications of gender identity," she said. "There is now sufficient evidence to suggest that an epigenetic imprint for gender is a logical conclusion. It would be strange if this were not the case, because all environmental influences of any importance can epigenetically change the brain."

Forger, with doctoral student Laura Cortes and post-doctoral researcher Carla Daniela Cisternas, reviewed previous studies of epigenetics and sexual differentiation in rodents, along with new studies in which gendered experiences among humans have also been associated with changes in the brain.

In one example involving rats, the Georgia State authors cited a study by University of Wisconsin researchers who gave female rat pups extra attention designed to simulate the increased licking that mother rats normally perform on their male offspring. That treatment led to detectible changes in the brains of the female rats that received extra stimulation as compared to those who got the normal level of attention for female pups.

Among the studies involving humans, researchers considered the example of Chinese society during the Great Chinese Famine from 1959-1961, when many families preferred to spend their limited resources on boys, leading to higher rates of disability and illiteracy among female survivors in adulthood. This demonstrates, they said, that early life stress can be a gendered experience as it changes the neural epigenome.

"Given our lifetimes of layered gendered experiences, and their inevitable, iterative interactions with sex, it may never be possible to completely disentangle the effects of sex and gender on the human brain ," Forger said. "We can start, however, by including gender in our thinking any time a difference between the brain functioning of men and

women is reported."

The paper "Does Gender Leave an Epigenetic Imprint on the Brain?" is published in the journal *Frontiers in Neuroscience*.The study was supported by a National Science Foundation Graduate Research Fellowship and a Georgia State Brains & Behavior Seed grant.

More information: Laura R. Cortes et al. Does Gender Leave an Epigenetic Imprint on the Brain?, *Frontiers in Neuroscience* (2019). DOI: 10.3389/fnins.2019.00173

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