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HD The Gendered Brain by Gina Rippon review — do men and women have different brains?

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This attempt to argue that there are no innate sex differences is too extreme, says Simon Baron-Cohen

‘The hunt for differences between the brains of men and women has been vigorously pursued down the ages with all the techniques that science could muster,” says Gina Rippon in

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The Gendered Brain

. “It has been a certainty as old as life itself that men and women are different. The empathic, emotionally and verbally fluent females (brilliant at remembering birthdays) could almost belong to a different tribe from the systemising, rational, spatially skilful males (great with a map).”

Rippon, a professor of cognitive neuroimaging at Aston University, Birmingham, argues in her entertainingly written book that any differences between men and women are not due to prenatal biology, but because “our fantastic plastic brains are plunged into a gendered world, a world that has for hundreds of years treated the sexes differently”.

First, she asserts that there is no binary characteristic in the brain that all males have and that all females don’t, or vice versa. However, she is attacking a straw man. No serious scientist would argue for such binary differences. Rather, they would argue for

average

sex differences, when you compare groups of males and females.

For example, in 2018 I was part of a team at Cambridge University that published the largest study of sex differences. More than 500,000 people took part online. It found that on average women report higher empathy and men report a stronger interest in systems (understanding machines, numbers etc). Thus, 40 per cent of women versus 23.9 per cent of men scored higher on empathy than systemising; and 40.2 per cent of men versus 25.6 per cent of women scored higher on systemising than empathy. This suggests that there is overlap between the sexes, but that men and women tend to be different. It is comparable with height; there are tall women and short men, but on average males are 5.5in taller.

Rippon also builds her case with historical examples of “neurosexism”. One shockingly offensive example she quotes is from the anthropologist Gustave Le Bon, who wrote in 1895: “Women... represent the most inferior forms of human evolution and... are closer to children and savages than to an adult, civilised man.”

However, Rippon goes farther still. She argues that when research suggests males and female brains differ, this shows one of two things. Either that scientists are perpetuating such historical sexism in a

new guise. Or that brains at birth are the same, but change as they are exposed to sexist stereotypes. In other words biology plays no role. I'm sure she is right that our minds are affected by a world where gender roles matter, but to say that's the only process at work is extreme.

What are the average sex differences in the brain? In 2018 the UK Biobank released data on 5,216 adults who had had an MRI scan. This showed men's brains on average were larger in total brain volume, total grey matter volume and total white matter volume. They also found average sex differences in the volume of particular brain regions such as the hippocampus (which is involved in memory and spatial ability) and the amygdala (which is involved in threat detection and in empathy). These differences on average held up after "controlling for" total brain volume, the person's height and so on. Rippon is correct that these differences could be caused by living in a gendered culture.

An older study published in 1997 dissected 94 post-mortem brains and found males on average had 16 per cent more neurons (nerve cells) in their cortex than females. Males on average had 22.8 billion and females 19.3 billion. Again, one could just dismiss such a finding as a reflection of culture, not biology.

So has Rippon proved that it's all nurture and no nature? Not quite. In 2018 scientists reported that, at birth, intracranial volume is on average 6 per cent larger in males, and that at birth newborn boys tend to have more cortical neurons than girls. (Again, these remained true even after controlling for birth weight.) That's a bit awkward for Rippon's thesis, since at birth a baby's mind and brain have not yet been exposed to culture.

The newborns also showed other differences at birth. The medial temporal cortex, involved in sensory processing, particularly hearing, tended to be larger in males; and the dorsolateral prefrontal motor, involved in cognitive flexibility, planning and self-control, was larger in females. Again, this is awkward for Rippon's thesis.

In 2001 our team at Cambridge published what is still the only study of sex differences in 24-hour-old newborns. We showed babies a human face, or an object, to gauge what took their interest. While many babies showed no preference, more boys looked longer at the object and more girls looked longer at the human face. At 24 hours old, these babies could not possibly have been influenced by cultural expectations of what boys or girls ought to be interested in.

Rippon predictably attacks this experiment, which strikes at the heart of her thesis. She criticises it for not being blind to the baby's gender. However, the scientists took every precaution to remain blind, by having independent judges coding the videos of the baby's eye movements. One set was on the maternity ward and asked the mothers not to reveal their baby's sex, and the other set was in the lab so they could never know the baby's sex; all they saw was a film of the baby's eyes.

Rippon also attacks this experiment by saying this result has not been replicated. The truth is no one has tried to replicate it. It's a difficult experiment to conduct: you need to be on the ward in the middle of the night, when babies tend to be born, and recruit the mums into the study before they leave hospital the next morning. Finally, Rippon attacked the newborn baby experiment by saying the face and the object were not presented together. However, lots of newborn research presents one object followed by another; the key factor is that it should be done in a randomised order.

There is other evidence against Rippon's cultural determinist position. In humans we looked at prenatal levels of testosterone in pregnant women having amniocentesis. The male foetus on average produces twice as much of this hormone as a female foetus. Does this shape brain development? We found prenatal testosterone levels, measured during weeks 12 to 20 of pregnancy, correlated with the volume of key brain regions that show average sex differences when these children were of primary-school age.

Over time, the average differences between boys and girls were maintained in the planum temporale, involved in language skills, and the right temporoparietal junction, involved in empathy and taking another person's perspective. Higher prenatal testosterone levels also correlated with how strong a child's interest was in systems. Of course, correlation does not prove causation and it would be unethical to manipulate the hormones in humans to prove cause and effect. Nevertheless, it suggests these hormones contribute to making girls' and boys' brains different long before culture can operate.

Most biologists and neuroscientists agree that prenatal biology and culture combine to explain average sex differences in the brain. So why does Rippon box herself into an extremist position by arguing that it's all culture and no biology?

Probably because, like me, she's a child of the Sixties. If all differences are cultural, we can change to make society more equal. I am passionate for an equal society too. But our political beliefs — however sincerely held — should never make us selective when it comes to science.

Simon Baron-Cohen is professor of cognitive neuroscience at the University of Cambridge and author of

The Essential Difference

The Essential Difference

(Penguin Random House)

The **Gendered Brain**: The New Neuroscience That Shatters the Myth of the Female Brain

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