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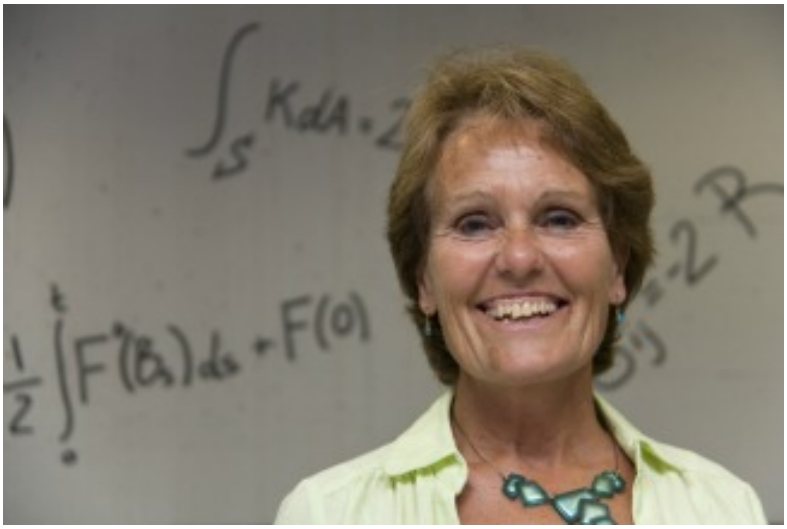
How the Brain Works, with Georgina Rippon



“Stereotypes Modify Brain Functions”

Sex, mathematics and brain formed the subject of the lecture offered by Georgina Rippon, of Aston University (United Kingdom), in occasion of the 15th general meeting of European Women in Mathematics, organised by the Centre Mathematics Research last September at UAB. Through brain imaging, Gina Rippon has long studied the cognitive processes and defends the lack of evidence to support that behavioral differences between men and women can be inferred from the differences in their brains. The influence of social stereotypes could be at the basis of this divergence, but Rippon warns that observing people through the prism of this dichotomy could make far more interesting differences go unnoticed.

Georgina Rippon, professor of Cognitive Neuroimaging at Aston University in Birmingham, UK, carries out research in brain imaging techniques with the aim of studying cognitive processes.

Her research is applied to the study of disorders such as autism and dyslexia. Professor Rippon claims a lack of scientific basis in neurosexist theories, which attribute differences in the brains of men and women to justify behaviour differences between the two sexes. In September, Professor Rippon participated in the 15th meeting of European Women in Mathematics (EWM), organised by the Mathematics Research Centre (CRM). Her conference, entitled “Sex, Maths and the Brain”, focused on differences often ascribed to male and female brains in the field of mathematics.

Why are there more men mathematicians than women?

The $64,000 question!! Girls tend to outperform boys in nearly all subjects (including Maths) up to the age 12-15. Those girls who continue to do Maths do as well as boys. But there is a dramatic difference in the number of girls choosing to study maths and Maths-related subjects in higher education and beyond, as well as a bigger drop-out from STEM (Science, Technology Engineering and Mathematics) subjects among females (the ‘leaky pipeline’). So it looks like women CAN do Maths but DON’T.

How are boys and girls affected by the stereotypes we impose on them during childhood?

In the same way that all family, peer, social and environmental pressures affect our behaviour and (as is now emerging) our developing brains. There is a strong pressure to ‘fit in ‘with the important groups in our lives and we tend to behave accordingly. adopting the standards, beliefs, prejudices etc of those we want to identify with. Stereotype threat is the experience of anxiety or concern in a situation where a person has the potential to confirm a negative stereotype about their social group. If you tell a bunch of girls that females tend to do badly in the kind of math test they are about to perform, then they underperform. It has recently been demonstrated that this can also affect how the brain processes information relevant to the test.

Have experiments been carried out on behaviour differences in newborn babies, before they are exposed to the pressure of stereotypes?

Yes – developmental psychology has come up with many ingenious ways of studying the behaviour of new-born and very young babies, to test preferences, individual differences, emerging abilities etc. It has been reported that there is early evidence of gender differences in these types of studies but a) they have been difficult to replicate and b) any differences reported are very small. Elizabeth Spelke has carried out a comprehensive review of reported differences relevant to differences in maths ability and has shown that none of them are reliable.

Are there notable differences between the brains of men and women?

It is first of all important to note what is meant by ‘different’. There are no absolute differences – there is no measure that is true of all men’s brain and no women’s or vice versa. If you are interested in structural differences, then mens’ brains are (overall) bigger, but if you take the differences in body size into consideration, this difference disappears, although there is evidence of consistent differences in the ‘length’ of the frontal lobes (longer in men). There are also some differences in volume in different parts of the brain and differences in the thickness of the cortex in different places.). There is emerging evidence that boys’ and girls’ brains mature at different rates so, at key stages in puberty, for example, it could well be possible to demonstrate quite

marked differences between males and females. But the most important differences are in the functional organisation of the brain (which areas of the brain are activated when a specific cognitive process is ongoing) and there is very little evidence to date of consistent gender differences.

Girls seem to score better academically. Is there a neuroscientific answer for this?

Depends on when you are measuring this. Almost universally, girls outperform boys in standard tests of academic achievement up to and including secondary education. There are a range of possible explanations including social expectations, behavioural differences, attentional differences – almost none in terms of differences in brain structure or function. It is possible that new research on differences in brain organisation and its changes during puberty may be relevant to academic differences reported at this time.

What is the most surprising result you have observed from your experiments with brain imaging?

I was involved in a series of studies on developmental dyslexia and, instead of looking at what the children couldn't do, we looked at tasks that they were as good at or better than when compared to children with reading skills normal for their age. We found that, even though the children with dyslexia showed performance levels the same as their chronological- and ability - matched peers, the patterns of brain activation were very different. So even when they were processing information successfully, it was associated with a very different 'brain strategy'.

What are you working on now?

The main focus of my research is currently into Autism Spectrum Disorders and the differences in the patterns of inter-connectivity between brain areas. We are looking at very simple aspects of cognition, such as vision and audition, to see if differences here underpin the range of problems that many of these children have. But I am also interested more generally in how we can use brain imaging techniques to understand how the brain develops and how this development affects what children can and can't do. This includes individual differences, such as gender, although I think that looking at people in terms of this particular dichotomy can mask much more interesting differences.

Octavi López
Àrea de Comunicació i Promoció de la UAB
octavi.lopez@uab.cat

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