

## 2015 Klaus J. Jacobs Research Prize “The Social Brain in Adolescence: Work in Progress”

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### **Sarah-Jayne Blakemore studies the development of the social brain in adolescence. What is meant by the social brain?**

The social brain is the network of brain regions involved in understanding other people’s minds, their mental states and emotions. Social cognition includes how people process, store, and apply information about other people and social situations. The study of social cognition focuses on the role that cognitive processes, including executive functions such as reasoning and problem solving, play in our social interactions. Social cognition and the social brain undergo protracted development during human adolescence.

### **How does the brain change in adolescence?**

Through behavioral as well as with brain scanning (Magnetic Resonance Imaging (MRI)) studies, Blakemore has demonstrated that the adolescent brain develops both structurally (i.e., changes in the brain anatomy) and functionally (i.e., how it processes information). MRI allows researchers to see what is happening inside the living human brain. MRI scanners use magnetic fields to form images of the brain and the body. Functional Magnetic Resonance Imaging (fMRI) measures brain activity by detecting associated changes in blood flow during cognitive tasks. The technique relies on the fact that cerebral blood flow and neuronal activation are coupled. When an area of the brain is in use, blood flow to that region increases because activated brain areas need more oxygen to help them work.

With regard to developmental changes in the structure of the social brain, Blakemore’s group has shown that grey matter volume decreases from late childhood into the early twenties. Grey matter is where cell bodies of neurons and connections (synapses) reside in the brain and spinal cord. The underlying mechanisms associated with a reduction in grey matter volume are still debated. It is suggested that reduction in grey matter volume might partly reflect synaptic reorganization. A synapse is a structure that permits a neuron (nerve cell) to pass an electrical or chemical signal to another neuron. Synapses increase gradually during childhood, peak in late childhood, and are then reduced by approximately 40% during adolescence and early adulthood before stabilizing.

With regard to functional developmental changes Blakemore’s work suggests that activity within the social brain shifts from anterior brain regions to posterior brain regions over the period of adolescence.

### **Blakemore’s research suggests that adolescence represents a period of high neural plasticity, in particular in brain regions involved in executive function and social cognition. What does this mean and what are the social implications of this research?**

Plasticity describes the ability of the brain to adapt its structure and function in response to environmental demands, experiences, and physiological changes. Periods of heightened plasticity during which the environment has a particularly strong impact on the brain and behavior are called sensitive periods.

The period of adolescence begins with the physical, cognitive, and social changes occurring with the onset of puberty, and ends with the social independence and stability of adulthood. The adults that emerge from adolescence must be equipped to navigate the social complexities of their community.

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Adolescents go through a period of social reorienting. During this period, the opinion of peers become more important than those of family members, being socially excluded is especially distressing, and peer influence on decision-making, risk-taking, and risk-perception are heightened. These characteristic behaviors of adolescence are fundamental to the successful transition into a stable adult role. Many cognitive abilities mature into adolescence. Developmental improvements in executive functions likely influence, and are influenced by, social cognitive processing during adolescence.

Blakemore has contributed to a body of scientific evidence demonstrating that the adolescent brain is continuing to develop. This ongoing change, particularly in areas of the brain involved in understanding other people, might indicate that adolescence is a time when the brain is especially sensitive to social learning and experiences. Adolescents are particularly sensitive to social and contextual cues, that is, to their socio-cultural environments. Thus, the complexities of the adolescent environment, and the opportunities made available to young people, may have a significant impact on how young people's brains are shaped.

Blakemore's findings have potential implications for education, criminal justice, mental health, and other public policy areas affecting young people.

If adolescent behavior is linked to approval from friends and to avoiding social exclusion, Blakemore suggests we examine how young people might positively influence each other's learning and decisions through peer education and mentoring. It would be worth testing whether peer-led initiatives might channel the natural propensity to take risks into positive contexts such as academic learning and career planning. What is sometimes seen as the problem with adolescents – risk taking, poor impulse control, self-consciousness – is actually reflective of brain changes that provide an excellent opportunity for education and social development.

Adolescence is a time of opportunity for learning new skills and forging an adult identity. Research on the brain basis of social development in adolescence might inform both curriculum design and teaching practice with the aim of ensuring that classroom activities exploit periods of neural plasticity that facilitate maximal learning.

The capacity of change is reflected in the extended neuroanatomical and functional development of the human brain. By understanding and harnessing the plasticity of the brain interventions might better prevent behavioral problems and promote prosocial behavior.