Using innovative neuroimaging techniques, Dr Margot Taylor and her colleagues have been the first team to investigate the impact of very preterm birth on social cognitive development.

Impaired theory of mind associated with very preterm birth – an invisible handicap

Everybody has a unique set of beliefs and principles, and the ability to appreciate these differing opinions is an essential part of social living. This phenomenon is known as ‘Theory of Mind’ (ToM) – termed a ‘theory’ because the mind cannot be directly observed. We can only interpret what others are thinking/feeling by their speech, body language and facial expressions. These cues allow us to visualise that person’s perspective and anticipate their behaviour.

As children develop, their ability to comprehend these emotive indicators improves alongside their emotional intelligence. ToM ability typically emerges between four and five years of age and development continues through adolescence into adulthood. In some cases, however, children do not master ToM and struggle to understand perspectives different from their own. As a consequence, these children may have difficulties across a range of social skills, such as understanding what others mean during daily social interactions or having empathy for others. Individuals who suffer from autism spectrum disorder, attention deficit disorder and schizophrenia are particularly prone to deficient ToM. As a result, these children and adults often find social situations stressful and difficult to cope with. However, because deficits in ToM are only apparent in social situations, ToM impairment is often not recognised until children start school, where adaptive social functioning becomes crucial, not only to making friends and dealing with new and complex social situations but also in learning.

ToM IN VERY PRETERM-BORN CHILDREN

Research has shown that poor ToM also occurs in very preterm (VPT) born children: babies born at a gestational age of less than 32/40 weeks. In Canada alone, over 4000 VPT babies are born every year. Even though improvements in neonatal intensive care mean that fewer VPT infants suffer from serious health conditions, over half of VPT children experience difficulties such as academic underachievement and cognitive impairment, including ToM deficiency. Despite the prevalence of VPT births and the subsequent detrimental lifelong impact, little is known about how neural pathways are affected by early birth, which leads to poor social-cognitive abilities, including poor ToM skills. By using innovative neuroimaging techniques, such as magnetoencephalography, coupled with classic ‘false belief tests’, Dr Margot Taylor and her colleagues, Sarah Mossad in particular, have been the first to investigate the impact of VPT birth on this critical social-cognitive skill.

FALSE BELIEF TASKS

A standard protocol used to assess ToM ability is the ‘false belief task’, whereby a person must realise that another individual holds a belief about a situation that is different from their own and from reality. The ‘Jack and Jill’ false belief task was used by Dr Taylor and her team to compare ToM abilities in VPT vs. full term (FT) children. Participants
Social-cognitive dysfunction is a common sequelae of VPT birth and disturbances in developing these skills have profound long-term consequences academically and socially.

Why is Theory of Mind (ToM) so important?
Theory of Mind (ToM) allows us to understand the beliefs, emotions or mental states of others and that they can be different from our own; this allows us to predict and understand others’ behaviour and is thus critical to adaptive social interactions.

Why is impaired ToM prevalent in very preterm born children?
We believe that very preterm birth impacts the development of brain networks critical for social-cognitive abilities; our studies will determine the atypical brain function underlying this.

What are the benefits of using magnetoencephalography to examine neural networks underpinning ToM? MEG is an exceptional neuroimaging technique as it provides information on both where and when in the brain processing is occurring. The speed of thoughts and where they are happening can change enormously with age and with clinical populations; being able to identify what the differences are allows us to understand why some groups are not able to master ToM skills adequately.

How can we treat impaired ToM?
There are interventions (often developed for children with autism) that can teach children how to behave more appropriately in social circumstances, and better understand what others mean with language and expressions. The children also need to learn what impact some of their own behaviours have on others. These interventions usually focus on intensive social modelling and role-playing approaches.

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The deficits are due to atypical brain injury, and can sustain white matter injury at birth. These effects can be seen throughout childhood, but do not relate directly to the social and cognitive deficits that this group often experiences. The deficits are due to atypical brain function and that needs to be studied by techniques such as MEG. Some of these VPT children show amazing resiliency despite early brain injury; we want to understand what underlies that, to be able to foster it in all of these high-risk children.

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What are the main neurological differences between very preterm and full-term infants?
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