ADHD linked to brain size

by Anne Blair Gould of our Science Unit, 7 April 2003

Attention-Deficit Hyperactivity Disorder, or ADHD, is a neurologically-based developmental disability affecting three to five percent of school age children. No-one knows what causes it or how it develops, but new research comparing boys with ADHD with their brothers shows that brain size could be a factor.

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Like healthy children, those with Attention-Deficit Hyperactivity Disorder have a great deal of difficulty in keeping still and paying attention, but in ADHD children the problem is much worse. Dr Sarah Durston, of Utrecht University in the Netherlands and Cornell University in New York, has specialized in studying ADHD patients. "Every kid is different; some kids have the inattentive sub-type and just have trouble paying attention and they aren't so much hyperactive and impulsive. But other kids have lots of problems in that area so they tend to blurt things out before people have finished speaking and are hyperactive - yet they're much better at actually paying attention."

What do we know about ADHD?

Although the problem has undoubtedly been around for a long time, the term Attention-Deficit Hyperactivity Disorder or ADHD was coined only about 10 to 15 years ago. Before that, it was known as Minimal Brain Damage. As to what causes it, we have just a few clues. Dr Durston says: "It's very complex but we do know that genetics play a role, as ADHD tends to run in families, although we don't yet know which genes are involved. We also think ADHD-development is affected by environmental factors such as drinking alcohol and smoking during pregnancy."

Size of brain

In an effort to find out more about this disorder, Sarah Durston has been using Magnetic Resonance Imaging (MRI) to look at the anatomy of the brain in 30 sets of brothers, one of whom has ADHD, while the other is symptom-free. "That was quite difficult in itself," said Dr Durston, "because so often brothers of ADHD patients are also affected or have related disorders like dyslexia."

The study involved making 3D images of the brain and measuring the volumes of various parts of the brain in both brothers. And the results? "We found that the volume of the cranium — that is the brain case — was smaller for both the ADHD patients AND their brothers. This is interesting because it implies that the anatomical effects of ADHD - a slightly smaller brain - are there in both brothers, suggesting a genetic cause."

Size of brain areas differs

However, when Durston looked at individual regions within the brain, she found some differences between the brothers. "For some areas of the brain, the brothers showed similar reductions in size, but in others - specifically the cerebellum - the ADHD patients showed a greater reduction in the brain volume." In other words total brain-size in brothers is similar but the ADHD-patient has a slightly smaller cerebellum than his healthy brother. "This suggests," says Dr Durston, "that either there's something else going on on top of genetics or that there's an additional genetic factor not shared by the symptom-free brother."

And what role does the cerebellum play? "We know it's important for motor co-ordination," says Sarah Durston, "but we think it also plays a role in cognitive processing. So it would be interesting now to develop experiments in which the brothers do tasks differently — and at the same time, use Functional MRI techniques to look at the cerebellum."