

Young minds in hi-tech turmoil

Could computers be changing children's brains? Baroness Susan Greenfield and other experts certainly think so. And now a parliamentary inquiry has been set up to look at the scientific evidence. Hilary Wilce reports

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Is modern life cooking up a new kind of human being, whose altered circuitry will cause them to think and act differently from people today? It sounds like science fiction, but a growing number of specialists feel that tomorrow's classrooms are likely to be filled with pupils who will think more episodically, have shorter attention spans, communicate through pictures rather than words, have more learning difficulties, and be less able to control their impulses and emotions than the children of today.

Baroness Susan Greenfield, director of the Royal Institution of Great Britain, is one leading neuroscientist who believes that using computers could profoundly affect how children think. Earlier this year she warned the House of Lords that the computer culture could lead to a loss of the ability to set information in context. Now she has set up an all-parliamentary group to bring together the work of brain scientists and educationists.

"I'm not a Luddite, but technology is a powerful tool and to just let people have unfettered access is like handing people car keys without teaching them how to drive," says Greenfield. "Anecdotally, there's real concern about this. Everywhere I go, people come up to me and say, 'I'm very worried about my eight-year-old'".

Former education secretaries Shirley Williams, Estelle Morris and Gillian Shephard are among those on the group looking at how scientific research might influence education practice.

Meanwhile, public health scientists are warning that we could face a "silent pandemic" of developmental disorders such as autism and attention deficit and hyperactivity disorder (ADHD), from damage done by untested chemicals to unborn babies. Writing in *The Lancet* this month, Philippe Grandjean, of Denmark, and Philip Landrigan, of the United States, point out that 10,000 chemicals are approved for use in the European Union, many hundreds of which are likely to be toxic to the foetal brain. And a growing body of research is indicating that busy parents and sub-standard childcare could be changing how children grow up. It is now known that babies are born with their full complement of brain cells, then build links between them in the first years of life.

"But the things that shape children's brains are changing," says Sue Palmer, a literacy specialist, and author of *Toxic Childhood*. "Significant cultural changes mean that the neural connections are not being made, or are not going so deep."

Cuddles, singing, eye contact, talking and movement are all known to pattern a pre-schooler's brain and to help with reading and writing, and social and emotional well-being later on. But today's children are getting less of them. "As a society, we don't value nurture," says Palmer. "The main people seeing what this means are the early years people, and they are going barmy with worry!"

Her concerns recently prompted her to start a national debate on children and society. "There is a massive amount of research that shows that children in nurseries where there isn't a high ratio of adults to children - which is an awful lot of nurseries - have raised levels of cortisol," warns Professor Margot Sunderland, director of education and training at the Centre for Child Mental Health and author of *The Science of Parenting*. "And that means they have a hard-wired stress response system. But this often doesn't show up until adolescence."

In adolescence, she points out, the brain has another big growth spurt, but many teenagers do not get what they need for healthy brain development. "About a third are using the television or Game Boys to go to sleep, which activate dopamine, which is a stimulant. Yet sleep deprivation leads to irritability, aggression and poor learning. It's the same with testosterone. Adolescent boys have 50 times as much of it as when they are little, and this leads to a lack of concentration, aggression and poor learning. But when boys get enough quality time with their parents this surge does not seem to affect behaviour and learning. Yet the average child now watches 21 hours of television a week, and spends only 40 minutes with his or her parents."

A lack of active play could also be affecting how children's brains develop. Sally Goddard Blythe, of the Institute of Neuro-Physiological Psychology, says that many children now retain primitive, baby responses long after they should have developed higher levels of brain functioning, and that these reflexes impede learning. A new report from the Institute, on the progress of more than 1,000 children in primary schools, shows that just 10 minutes of structured exercises a day can improve not only children's balance and coordination, but also their concentration and achievement in maths, spelling, reading and writing.

Many teachers report that children are already changing. Jennie Carter, head of The Churchill School, near Folkestone, has studied how stress can block children's thinking and learning, and runs her school accordingly (see box). "When I started teaching I had 40 children in my class and no teaching assistant, but children weren't kicking off like they do now. They were much more able to monitor themselves and self-regulate."

In the United States, Jane Healy, an educational psychologist, has charted how children are becoming less attuned to written and spoken information, lack perseverance, are impatient, and show little curiosity about the world.

Neuroscientists say that the physical structure of the brain is the product of long years of evolution, but the way it works constantly adapts to circumstances. "The brain is just tissue," says Professor Usha Goswami, director of the Centre for Neuroscience in Education at Cambridge University. "So if the environment changes, it will change too."

And Martin Westwell, deputy director of the Institute for the Future of the Mind, at Oxford University, points out that it is the cultural value we impose on any changes that give them meaning. "People say children using computers will grow up with terrible handwriting, but you could say: 'So What?'"

Neither should agents of change be labelled good or bad, he says. "In some instances, technology appears to be changing the way we think, and there are people who feel nervous about this. But it's not the technology that's at fault, it's what you do with it that matters."

For instance, he says, a 2005 study found that after just 20 minutes of exposure to violent video games undergraduates were more likely to exploit other people than to cooperate with them. "Something in their brains had changed." But there is also plenty of research showing that computers can enhance learning.

John Geake, professor of education at Oxford Brookes University, says "the big problem with knowing what is happening in children's brains is we can't do the experiment. You would need to compare modern day kids with kids from the past and that can't be done. So then you need to ask: what is it about the brain that could be different? But it is very early days in this field. What will be really useful is when educators start to drive some of the neuroscience."

But Margot Sunderland believes that both parents and schools must start taking notice of brain chemistry now. "I think we should start paying mothers to look after children rather than nurseries. I think we need to take sleep deprivation very seriously, and I think schools need to look to things like yoga and massage which research has proved release oxytocin and have a positive effect on the brain. I also think we need to monitor and look after our teachers. How can they be the emotional regulators for these children if they themselves are stressed?"

And since drink and drugs are known to damage the vulnerable adolescent brain, she would also like schools to show pupils brain scans of what can happen. "Don't say, 'Don't drink', but 'Do you want to give yourself brain damage?'"

Churchill: the brain-friendly school

Jennie Carter knows that stressed children have raised levels of cortisol, and that this affects the development of the orbitofrontal cortex, that part of the brain that is concerned with empathy, concentration and self-control. So she runs the Churchill School, outside Folkestone (right), in a way that takes this into account. "Visitors always say it is very calm."

Language is central. Upset children are always given a chance to talk, no one ever shouts, and "all my teachers can talk about metacognition." Pupils are also graded for their involvement and well-being, using signs such as cheek colour and how engrossed they are in their work, in order to catch all problems. "If I ask a teacher to tell me the pupils in her class, it's always the one she can't quite remember that we need to think about."

In turn, children get to rate their teachers in online questionnaires, for the fairness, clarity and order of their lessons. "Pupils can't always tell you face-to-face if they feel annoyed or anxious."

Parents are invited in to learn about the importance of encouraging talk and discussion at home, and the school runs a support group for parents of children with learning problems - 10 out the 290 pupils are autistic.

The school opened five years ago in an area of new housing, and has a growing reputation. One mother, whose 10-year-old has flourished after transferring from another school, says: "His whole attitude has changed. They can't do enough here. Mrs Carter even rang me on New Year's Day because she'd read something about a programme that reinforces the connections of the ear to the brain and she thought it would be right for him!"

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