Praise for *Blame My Brain*

“Nicola Morgan has that rare gift of being able to communicate science and make it fun. She brings the biology of the brain to the general reader in a way that will not only educate but entertain.”

 **Professor Simon Baron-Cohen, Department of Developmental Psychopathology, Cambridge University**

“Brilliant! It taught me a lot about my brain...”

 **Ross Rae, age 13**

“... and me a lot about my son!”

 **George Rae, age 45**

“I want to say how much I enjoyed the book. It is excellent and just what is needed.”

 **Professor John Stein, Oxford University**

“Written for teenagers but invaluable reading for those coping with them – parents, doctors, and teachers – *Blame My Brain*, a guide to the biology behind teenage behaviour, is informative, accessible, interactive, and fun... Our practice has a books-on-prescription scheme. I am going to suggest that we get six copies of this book. In fact, maybe I’ll suggest that we get a copy for every family in the practice.”

 **British Medical Journal**

“It is very rare that an author succeeds in writing a book for teenagers which is also a ‘must read’ for their parents and teachers. Nicola Morgan has done just that. *Blame My Brain* does not seek to excuse teenage behaviour, but it certainly goes a long way to explaining it.”

 **The Scotsman**

“... a good resource to share with students to help them deal with what is potentially the most challenging, but also the most exciting, period in their development.”

 **Times Educational Supplement**
To my daughters.
If only I’d known all this sooner!

Acknowledgements

As I say elsewhere, I am not a scientist. But real scientists generously
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Introduction

All parents were once perfect teenagers. Model humans. Never drank, smoked, swore or lay in bed all morning. They were completely in control of all their hormones. In fact, they probably never had any hormones at all. They were calm, always smiling and incredibly polite to everyone around them.

All parents also have amnesia. That’s why they think the above paragraph is true.

If adults only knew the truth about the teenage brain, they’d realize that they couldn’t have escaped its special behaviour. If they read this book, they might begin, gradually, to remember

If the human brain was simple enough to understand, we’d be too simple to understand it.
Emerson Pugh, 1977

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A note from the author: why this new edition?

Because now we know even more than when I wrote the first edition and I’m so fascinated by it that I had to tell you! I also wanted to check everything against our new knowledge. Since Blame My Brain was first published in 2005, scientists around the world have been doing more and more research, which adds to what we knew. There’s new information on emotional processing, pruning of connections, risk-taking, sleep, and alcohol and drugs. And I will introduce you to the fascinating world of mirror neurons. In short, with this edition, teenagers and all the adults who care about them can know even more about why adolescence can be such a stressful and tumultuous time, as well as an incredibly important one.
the truth about their teenage years. What they don’t realize, and what this book sets out to show, is that the teenage brain has always been special. Different, fascinating and important things are happening inside it, which happen to everyone. Some of this is new information, or supports what scientists have recently known. Most adults will be surprised, fascinated and reassured by the contents of this book.

I want to give you a behind-the-scenes look into your own brain, so next time you’re facing a row for not getting out of bed before lunch or not going to bed before dawn, for swearing at a teacher, for smoking even though it’s bad for you, for reacting emotionally, for taking risks, for generally being stroppy, you could just say, “Don’t blame me – blame my brain.”

Actually, none of this is exactly an excuse: it’s an explanation. Once you know what’s going on in your brain and why, you can work with your brain instead of being so stressed out by it. Knowledge and understanding are half the battle.

You might even decide to respect your brain and treat it a bit better, once you know what’s going on inside it.

Read on and be amazed.

Nicola Morgan
Edinburgh, 2013

Brain Basics

There are a few things you need to know so that the rest of the book makes sense. You need some basic facts about brains and how they work. Then, when I use a word like neuron later, you’ll know what I’m on about. And if you forget, you can come back to this section.

BRAIN BASIC 1: WHAT’S IN A BRAIN?
The human brain contains about 100 billion nerve cells (neurons). Each neuron has a long tail-like part (axon) and many branches (dendrites – from the Greek word dendron, meaning tree). A neuron sends super-fast messages to other neurons by passing a tiny electrical
current along its axon and across very tiny gaps (synapses) into the dendrites of other neurons.

If the neurons did not communicate, your body would do nothing. Every single thing you do – every thought, action, sneeze, emotion, even things like going to the toilet – happens when the neurons send the right messages, very fast, through this incredibly complicated web of branches.

Each time you repeat the same action, or thought, or recall the same memory, that particular web of connections is activated again. Each time that happens, the web of connections becomes stronger. And the stronger the connections, the better you are at that particular task. That’s why practice makes perfect.

But if you don’t use those connections again, they may die off. That’s how you forget how to do something – forget a fact or a name, or how to do a maths calculation, or how to kick a ball at a perfect angle. If you want to relearn anything, you have to rebuild your web of connections – by practising again. After a brain injury, such as a stroke, someone might have to relearn how to walk or speak. That would be if the stroke had damaged some neurons and dendrites which help to control walking or speaking.

We all have different skills. The brains of a pianist and a footballer will have different numbers of dendrites and synapses in different areas of their brains.

When a human baby is born, it has almost all of its neurons. But it has few dendrites and therefore few synapses connecting them. That is why babies can’t do very much. But their brains develop fast. The fastest time of dendrite development in a baby is at around 8 months. Eventually, there can be up to 100,000 dendrites on every neuron, making 100 trillion connections.

The brain is made of grey matter and white matter. Grey matter is mainly made up of neurons and you find most of it in the cortex (the outer wrinkly bit of the brain, which is only about 2 millimetres thick). White matter is mostly below the cortex and is made up of all the axons that carry messages between neurons. We could call grey matter the “clever stuff”. But it couldn’t do very much if there wasn’t plenty of good strong white matter too.

You also have brain cells called glial cells. These can’t carry messages or make you do anything, but they support and nourish the neurons and help remove debris.

BRAIN BASIC 2: MIRROR NEURONS

There is a fascinating type of neuron called a mirror neuron. These were first identified by scientists in Italy in the 1990s and they are beginning to offer real insights into how we all learn. When we do something, neurons in the relevant part of our brain fire up, sending messages to enable us to act. But some of our neurons – mirror neurons – fire up when we simply watch someone else perform an action.
Those same mirror neurons will also be used when we perform the action ourselves. So, if we watch someone do something a few times, when we come to do it ourselves it may be easier because some of our neurons have already actually practised the action. Some scientists believe that mirror neurons have a role to play in empathy – feeling what others feel.

So, how the people around us behave should be very important for how we behave – and that’s not just for young people, but people of all ages. It helps explain how we learn by imitation.

**BRAIN BASIC 3: MAKING CONNECTIONS**

The connections do not happen of their own accord. Or randomly. Connections grow when we do something. Each time a baby tries to focus on an object, this makes connections multiply and then strengthen in the parts of the brain which deal with seeing. And in the parts which deal with understanding what we see. And in the parts that deal with remembering what we have seen.

I think it’s also interesting (though perhaps a bit frightening) to know that scientists have also discovered that there are critical periods in a brain’s development and that if the brain doesn’t get the right practice at the right time, it may not be able to learn certain skills later. That’s why, if you don’t learn a foreign language before the age of about 7, you could still learn to speak it fluently but you’ll probably always speak it with the wrong accent, because you have passed the stage at which the brain can pick up accents. It’s also why, if a baby doesn’t have an opportunity to use its eyes properly at around 8 months old, its sight will never develop properly later. But, luckily for us, most skills are not like this: most skills can be picked up later even if we miss out on some early learning.

If you think of your brain cells and connections as being like trees, it’s easier to picture what’s going on. Imagine starting with a very simple tree with a few branches – if you water and feed it, it will grow lots more branches. That’s a bit like what happens when you do or practise something – it develops the brain cells which are responsible for that particular thing. And makes them grow more branches, or stronger branches.

**BRAIN BASIC 4: BRAIN ZONES**

Although each human is a unique individual, our brains all have the same areas or sections, all working roughly in the same way (though there are some wonderful
The next picture shows you the main brain parts and the main things they help control. You have two halves to your brain and each half looks very similar to the other half and has matching sections. They are connected, and for most activities you use both halves together but in slightly different ways.

The left half of your brain controls everything on the right side of your body, and the right half controls your left side.
Scientists used to think that:
- we are born with all the neurons we’ll ever have and that no more grow – WRONG
- almost all the brain’s growth and development happens by about the age of 3, and hardly any dendrites or connections grow after this – WRONG
- after the age of 5 or 6, neurons start dying and are never replaced – WRONG

This is known as the “three-year myth” – the wrong belief that all important development is done in the first three years and after that it is downhill all the way.

We now know that the brain continues to develop and even to grow more neurons later in our lives, too. Yes, older adults can learn new skills, making new connections between existing cells and sometimes growing new neurons. And, importantly for you, we know that adolescence is a time of major change in the volume of grey matter, and that some parts of your brain are affected more than others.

BRAIN BASIC 6: WINDOWS INTO THE BRAIN

How do we suddenly know so much more about the human brain? Our increasing knowledge comes from technology that allows scientists to see inside a living, conscious brain, without risk to the brain’s owner. Before, the only ways of examining a human brain were to dissect
it or to use scanning techniques which involved things like injecting radioactive dye into people. This meant that scientists didn’t have the chance to examine healthy brains and couldn’t scan the same person over and over again, because the techniques could be harmful. Also, the old methods couldn’t say anything about what was happening in the brain while the person was doing something.

Everything changed when a new technique came along: functional magnetic resonance imaging (fMRI). This allows researchers to examine what is happening in someone’s brain while they perform any particular activity. If you had your brain scanned using fMRI, we’d see exactly what parts of your brain were being used during a particular activity.

Because fMRI is harmless, scientists can now scan, measure and compare the brains of healthy, active teenagers. At first, they were amazed by what they saw and they are still finding more fascinating and detailed insights into the brains of adolescents. The teenage brain really is special.

A Word About Genes

Actually, I’m not going to talk about genes at all in this book. Some people might find that a bit odd. After all, our genes (as well as our environment and the things that happen to us) make us who we are and have an enormous part to play in what our brains are like. They are the codes which we inherit from our parents (and other more distant ancestors) and which can be found in all cells in our bodies. They make you different from me and more like your brother or sister than anyone else in the world. But they are not relevant to this book, which talks about how teenage brains in general are like other teenage brains and unlike the brains of older or younger people. You can blame your genes as well, if you like – in other words, your parents. And grandparents. And all sorts of dead people you never knew. But it’s not nearly so interesting as looking inside your own head.
Matt’s parents are worried about him. He used to be a model pupil but recently his grades have slipped. He is moody, spends a lot of time in his room, and listens to dreadful music with lyrics which are negative, depressed and frankly weird. He has posters of Kurt Cobain around his room and when his mum asked politely why he liked Kurt Cobain his answer was: “Because, like, he killed himself and that is just SO neat.”

“Unlike your room,” she joked, trying not to react.

“God, Mum, you’re always going on. Just leave me alone!” he shouted, giving her an odd manic glare. Was he on drugs? she wondered.

Anyway, yes, so they are worried about him. They only want him to be happy. And safe. And nice to them. And successful. And an A-grade student. And get a brilliant job. And score more goals than anyone else in the inter-schools football tournament when everyone is watching. Yes, they are worried about Matt. But it’s only because they care. It’s a tough world out there and how will he get on if he shouts at his parents? Will he shout at his employers too? Will he be a complete failure? It’s enough to drive a mother to breaking point herself.

So, this evening, Matt’s mum has decided to have a little chat. Just a relaxing chat about nothing in particular. A chance to do some mother-son bonding. She’s going to go into his room and ask how his day was. No pressure.

She knocks on the door. No reply. Again, louder. No reply. So she turns the handle, at the same time calling his name. The room is quite dark. There’s a smell of incense. But she will ignore that. It’s quite a nice smell, actually. Soothing. Though no amount of dry-cleaning will ever get it out of the curtains. And she made those curtains herself, sewed till her fingers bled, to make the house look beautiful, and what does Matt care? She pushes aside the shiver of teeth-grinding irritation.

“Matt,” she calls. He is lying on his bed, eyes closed, headphones wrapped around his head, drumming the beat on his mattress. His homework is lying open on the desk. Peering through the gloom, she reads the title: “To what extent was Macbeth’s downfall within his control?” He has written two lines so far: “In the

Meet Matt. And his mum. There is an emotional war going on. And neither of them knows why.
play *Macbeth* by William Shakespeare, Macbeth has a very tragic downfall. It was entirely the witches’ fault because they shouldn’t of ever said what they said.” Crammed into the margin are detailed doodles and when she looks closely she sees they are dozens of hangman’s nooses all entwined together.

She moves the burning incense to a safer place and accidentally kicks over a can of Coke on the floor. Matt opens his eyes.

“Mum! What the hell are you doing? This is my room! Get out! OK?”

“Yes, sorry, Matt. I did knock.”

“Yeah, well, knock louder next time.”

“I just thought I’d come and ask how your day was. Can I get you anything? I could bring you some tea or something. It’s quite a good idea to drink tea while you’re doing your homework. Relaxing and stimulating at the same time.”

“Yeah, well, I’m not doing homework, am I?”

“Don’t you think you should finish this essay?” she says, pointing at the almost empty page.

Matt rips his headphones off and with exaggerated effort hauls himself to his feet. He is six inches taller than his mum and looking down on her is a great feeling. “Look, butt out, Mum. It doesn’t need to be done for ages.”

“When?”

“Like, days. I don’t know, Friday or something.”

“Don’t you even know?”

“Yes, it’s written down. It’s under control. I’m not stupid, you know.”

“Well, OK, but how about doing some other homework then? There must be something that needs to be done for tomorrow. It’s a good idea to try to be ahead of things, Matt. Don’t you get weekly French tests? I could test you or something. It’s so much easier to learn when someone tests you.” She picks up a book from a pile on the floor.

You can almost see the electricity fizzing through Matt’s body. You can see the anger in his clenched muscles and his thunderous face.

“Put it down, Mum. Leave me alone! I’ll do it by myself. You don’t know any French anyway.”

“Well, if you will do it on your own, fine, Matt. But will you? That’s what I want to know!”

“Oh, right, so you don’t trust me now?”

“Well, I want to trust you. But how can I trust you after last week, when I found that message in your notebook from Mrs Legless saying you hadn’t done your homework?”

“That was just once!”

“And the week before? Mr Golightly?”

“That was because you made me do the ***** housework!”
“No, Matt. You have your chores to do at the weekend and you know the deal is that if you don’t do them then, you have to do them during the week.”

“It’s unfair. No one else has to do chores. Why does the house have to be so bloody tidy anyway? What are you? A cleaning obsessive? Even my friends think this house is weird cos it’s so clean. There’s medical treatment for people like you – I was reading about it the other day. There’s even a name for it. It’s a mental disorder. You should see a doctor.”

“That’s enough, Matt!” shouts his mother. “Don’t speak to me like that!”

A voice shouts irritably from downstairs. Matt’s dad. “What’s going on, you two? Keep the noise down, for goodness’ sake! I can’t hear myself think.”

Matt looks at his mum triumphantly. She fumes, betrayed, furious. And it had all started with her offering to help.

She picks up some dirty socks and leaves the room. Matt slams the door.

“Don’t slam the door!” she shouts.

“Get out of my life!” he yells back.

Five minutes later he comes downstairs.

“There’s a party at someone’s house on Saturday. Not sure where. I need new jeans. Can I have some money?”

What’s going on in Matt’s brain?

Why does a previously sensible, happy boy, who was ticking along quite nicely, working reasonably hard, being reasonably nice to his parents, suddenly turn into someone whose anger erupts like a volcano at the slightest hint of intrusion? Why the arguments that blow up out of nothing? And why does Matt feel lousy inside with that eternal cry of “It’s not fair!”?

Experts used to say, “It’s just hormones”, or “It’s just a natural desire to break free from parents and move towards independence.” Both those things are partly true. But new research shows something very special going on in the teenage brain. Something which makes it work in a different way – something which even makes it look different inside from either a child’s brain or an adult brain.

Before you read on, remember two things: first, not all teenagers go through this difficult emotional phase. Second, teenagers are not the only people who can be irrational and emotional, volatile, argumentative and snappy. Ever look at the adults around you? What’s their excuse for rattiness and foul temper? They would probably say that YOU are their excuse. Hmm.

Previously we thought that teenage humans were the only ones to go through adolescence, but when scientists looked at other mammals, like rats and monkeys, they
found similar changes in the brain and similar changes in behaviour. Maybe rats feel ratty too.

What about Matt and his arguments? What’s this got to do with our new knowledge about teenage brain changes?

Scientists are careful about drawing conclusions. They say: “We see these changes in the brain and we see these changes in behaviour: they might be linked but we can’t be sure exactly how.” They’re right to be cautious – scientists are supposed to be cautious – but let’s look at what we see, because it is fascinating. And all the scientists agree on THAT.

First, we see a major increase of grey matter in the prefrontal cortex – the part of the brain that has most to do with thinking, reasoning, logic, decision-making. It is like a tree suddenly growing and branching out in the spring. This increase mainly happens just before puberty, usually between the ages of 10 and 12. The peak of grey matter growth is at around 11 years for girls and 12 for boys. In fact, far too many connections or synapses grow at this stage (which is also what happens in a young baby’s brain). They will need to be cut back, or pruned, which is what happens next. After the huge growth which happens just before and at the start of puberty, you have a period during adolescence where the branches are cut back or pruned. It’s as though the cells the brain doesn’t need just fall away. Scientists think that this pruning is more important than the growth, like pruning a tree to make its branches fewer but thicker and stronger. By the age of 16 or 17 you have adult levels of synapses – but when you were 1 or 2 you had twice as many.

During normal adolescence you lose around 15% of grey matter from your cortex. Then, in late adolescence and into early adulthood, the brain spends time building up and thickening the branches that are left, coating the axons to make them strong. This strengthening stage is called myelination. There is more about it in Chapter Six.
Adolescence is a period of huge and surprising physical change in the brain. It is as though many different parts are being remodelled to work in the more complex ways necessary in adult life. And during this upheaval and change, maybe the pathways for sensible behaviour are just not working well.

In support of this theory, researchers have found something else very interesting about Matt’s brain. It’s time you took the teenager test.

Look at the picture opposite.

What emotion do you think this person is showing? What is she feeling? Think about it for a few seconds.

Now turn the page.
Dr Deborah Yurgelun-Todd, the researcher who discovered this interesting behaviour, suggests that this *may* mean that teenagers have difficulty reading the faces of the adults around them – they may think an adult is showing anger when it is worry and concern, or disgust when it is simply surprise. She found that boys are also slightly worse than girls at this, and seemed to be using their emotional amygdala more strongly. The research is still going on, and even more interesting things may yet be discovered. Some research suggests that 11-12 year olds are 15% slower than younger children at matching the emotion on a face to the emotion word, and that this ability doesn’t recover fully until about the age of 16. (This result hasn’t been repeated, so it may turn out to be different when more research is done, but it does seem that many young adolescents have particular problems with this task.)

Now, we can’t say, “We see this in the brain, *therefore* teenagers are reacting emotionally instead of logically.” Brains are not that easy to understand. What we can say is, “The teenagers get it wrong and seem to be using a different part of the brain *while* they are getting it wrong.”

It makes you think, though. Is the way Matt’s brain is currently wired up affecting the way he interprets his mother’s face and voice? Is he misreading her signals? Is he unable to work out that, actually, she does want the best for him, *is* concerned about him, does want to help
of strengthening myelination yet.
Matt's behaviour could be affected by all this change, and this is perhaps partly why he behaves like the “typical teenager”. Personally, I can’t see how he could avoid being affected. After all, it’s our brains that make us feel the way we do.

Apart from anything else, Matt is probably under stress from many things going on in his life – friendships, pressure at school, exams, fears for the future – and stress does make us more ratty, more snappy. Add that to what’s going on in his brain, and you have a recipe for volatility.

**Psychologists say that there are 412 separate emotions which humans can feel, each of which we express on our faces. If you want to see how good you are at telling what someone is feeling, try the test at the end of this chapter.**

Mind you, let’s remember that parents can also be emotional, furious, illogical, irritating, irrational, uncontrolled, plain stupid. And regret it afterwards if they’ve got any sort of decency. Wouldn’t it be interesting to see an fMRI scan of what’s going on in a parent’s brain during arguments with teenage offspring?

A possible theory about what is going on in Matt’s brain is this: the early teenage brain is changing its structure. First it increases in density and number of connections, far more than it needs, especially in the prefrontal cortex. Then it does massive pruning, losing connections in some areas and restructuring itself in ways we do not yet understand. And Matt hasn’t reached the final stage of strengthening myelination yet.

**Other emotional brain differences**
Recent studies have shown other differences between teenage and adult brains when they think about emotional situations. For example, research shows teenagers and adults using different parts of the brain when thinking of socially embarrassing situations. Interestingly, some studies show areas of the prefrontal cortex working harder in teenagers than in adults for some activities. So, it’s not at all the case that your prefrontal cortex is sleepy: just that it works differently and may produce different results.

**Hormones**
What about hormones? Hormones are the chemicals which adults for generations have blamed for all teenage
Why do we have adolescence?

And why is it so much longer in humans than in other animals?

We now know that some other mammals have a period of adolescence, too, including monkeys, rats and mice. New research in the US on macaque monkeys has shown more clearly than before that neurons and synapses are pruned away during adolescence, as they are in humans. Those mammals that have a period of adolescence get through it much more quickly than humans. The female rhesus monkey goes from puberty to adulthood between the ages of around 18 and 48 months – and displays many equivalent characteristics, including teenage sleeping patterns, risk-taking and spending huge amounts of time hanging out with other adolescent monkeys. Maybe they even do the monkey equivalent of swearing at their parents.

Here are some ideas about why humans need a relatively long adolescence and why it’s the emotional ride that it is. They are not separate possibilities but are closely linked together. For example, evolution is responsible for our biological make-up, and our biology in turn leads to the way we behave as a society. So don’t look at them as separate theories, but just as different ways to focus your thoughts.

**THEORY 1 – IT’S EVOLUTION**

An evolutionary biologist always looks at questions like this by saying: “This must have given some advantage to early humans. What could it have been?” In the case of adolescence, it could be because early human society was much more complex than other animal societies, so we needed more time to learn the skills required.

**THEORY 2 – IT’S CULTURAL**

There are adults who say, “Huh, it was different in my day. In my day we weren’t allowed to feel like that. We just did what we were told. This modern teenage behaviour is all...
ongoing research shows that teenagers even use different parts of the brain and sometimes make different decisions depending on whether their friends are with them. Friends are everything – because friends are what we need when we leave home. Humans rely on sociability. It makes sense to cultivate friends. In fact, this drive towards independence is possibly the most important thing about adolescence. It is, if you think about it, pretty much the whole point. And it's what your parents and all the adults who care about you want for you in the end. What they may not realise is that if you're going to be independent at 22 you may need to start rattling the bars of the cage at 14.

THEORY 3 – IT'S THE NEED FOR INDEPENDENCE
All mammals need to leave their parents and set up on their own at some point. But human adults generally provide a comfortable existence – food arrives on the table in quantities, money is dished out at regular intervals and can be pleaded for more or less successfully, the bills get paid and the electricity for the TV doesn't usually run out. If teenagers didn't build up a fairly major disrespect for and irritation with their parents or carers, they'd never want to leave. In fact, falling out of love with the adults who look after you is probably a necessary part of growing up. Later, when you've gone, you can start to love them again because you won't need to be fighting to get away from them. And you can come back sometimes for a home-cooked meal and even bring your dirty washing with you if you play your cards right.

The need for separation could also explain why teenagers are far more concerned about what their friends think than what their parents think. Recent and ongoing research shows that teenagers even use different parts of the brain and sometimes make different decisions depending on whether their friends are with them. Friends are everything – because friends are what we need when we leave home. Humans rely on sociability. It makes sense to cultivate friends. In fact, this drive towards independence is possibly the most important thing about adolescence. It is, if you think about it, pretty much the whole point. And it's what your parents and all the adults who care about you want for you in the end. What they may not realise is that if you’re going to be independent at 22 you may need to start rattling the bars of the cage at 14.

THEORY 4 – IT’S JUST THE WAY THE BRAIN IS
We could simply say that it’s not surprising the brain has this confusion and can’t work entirely effectively, because there is so much change happening. Adolescence is an unfortunate side effect of all that change, and that’s all there is to it.

Which theory do you find most interesting? Evolution? Culture? The struggle towards independence? Or just coincidence?
**Bedrooms – a mirror on the teenage brain**

In the first edition of *Blame My Brain*, I was quite dismissive about untidy teenage bedrooms. I really didn’t think they were important or interesting. Not my business, I thought. However, I have decided that perhaps they are quite interesting. (By the way, I know lots of teenagers don’t have untidy bedrooms but let’s face it: many do...) Here’s what I think:

- Teenagers usually have a very small bedroom and a lot of stuff to keep in it. You also have to do a ridiculous number of things in your room so it’s hardly surprising if it becomes a tip.

- You have far more important and stressful things going on in your lives than whether your bedroom is tidy or not.

- Many of you probably would like your bedroom to be tidy but the effort of tidying it is often greater than the desire for it to be tidy. A magic wand would be nice.

- An untidy bedroom is the result of dozens of tiny decisions: “Put it away now or drop it and put it away later.” The first option is boring and unattractive, giving you an immediate unpleasant task (and you often focus more on the present, using your powerful emotional side.) The second option is easy, especially since the “putting it away later” bit feels very unreal and not worth thinking about, because it’s not to do with the emotional pull of the present.

- It can be a wonderful way to annoy parents.

- It’s actually quite a safe thing to argue about – better than smoking or alcohol or sex or homework or any of the other things that worry parents.

So perhaps your untidy bedroom (if you have one) could be a mirror of your mind: emotional, chaotic, rebellious and full of stress. Or maybe actually you really aren’t bothered?

**What can you do about adolescence?**

You might think you can’t do anything about it, except go to sleep for a few years and wake up when it’s all over. Actually, there’s a lot you can do – not to stop it happening, but to deal with it and look at it differently.

- Enjoy it. Celebrate it. What is there to be negative about? Emotional reactions are good. In fact, you could say that without emotion we’d be pretty
unsuccessful as a human race because we wouldn’t be able to make any decisions. Logic on its own is not enough. Richard Cytowic, in *The Man Who Tasted Shapes*, talks about a wonderful fact from the animal kingdom: the Australian anteater has an extraordinarily large frontal cortex, much larger than the human one in comparison to the animal’s size. It should be well up there in the genius stakes. But, as you may have noticed, the Australian anteater has not exactly taken over the world; nor have Australian anteaters ever reached the moon or built cameras so small they can travel down a blood vessel. So what went wrong? Why are they so seemingly brainy but so conspicuously useless at anything apart from ant-eating? Well, rather interestingly, they have a very weak limbic system – the bit which is most important in emotions. They also apparently don’t dream. Not even about ants. Australian anteaters are, perhaps, not nearly emotional enough. It’s an interesting thought. Emotion may be very important indeed when it comes to success.

- Make the adults in your life read this book – they will soon see what’s going on. They will sympathize and become immediately reasonable. Or, on second thoughts, don’t let adults read this book – they will start being very smug, and make comments like:

  “Never mind, you can’t be expected to make a sensible decision because your teenage brain is in the middle of losing all its branches. Let me make the rules until you’ve grown up.”

- Understand what is going on. Recognize that this is a necessary (and temporary) phase. Whatever anyone says or whatever you imagine they think, it does not mean you are a horrible person.

- Try to treat yourself and your brain kindly and with respect. Stress is a common part of adolescence – the stress hormone, cortisol, is more easily produced at this time. Some stress is good for us because it makes us do things, makes us able to perform well, but too much is not.

- Remember: although it’s helpful and reassuring to know that this is all “normal”, our brains develop and improve through effort. So (and I apologise for saying what you don’t want to hear!) the more you try to make your brain behave in the way you want it to, the quicker it will. Exactly the same applies to adults, by the way. So, you have my permission to remind your parents, next time they do something wrong, that they may just need to try a bit harder. Don’t blame me if that doesn’t help, though. And please don’t try it on your teachers.
What we now know about mirror neurons (see Brain Basic 2) also suggests that when you watch others exercising self-control (or doing whatever it is that you want to do better) it could help your brain develop in that way. So, the adults around you need to set a good example. We often learn by imitation.

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**FASCINATING FACTS ABOUT YOUR ILLOGICAL, OVEREMOTIONAL BRAIN**

- By the age of 6, the brain is 95% of its adult size, but during the teenage years the frontal cortex will increase and then decrease in thickness by perhaps 15–20% in some parts. The extra thickening comes mainly from increase in dendrites and synapses, and thicker axons. The thinning or pruning stage is important for good function.

- More neurons do not always mean a better brain. For example, in a condition called Fragile X, the problem is too many neurons. A good brain is well pruned and structured, with the pathways working effectively together.

- The gap which makes a synapse is very tiny: 200,000th of a millimetre. Roughly.

- Many studies show that a human frontal cortex is four times the size of a chimpanzee’s. But some new ones suggest that they may be much more similar than that.

- The frontal cortex makes up 29% of the human brain but only 3.5% in cats – partly explaining why we are cleverer (though don’t forget that bit about the Australian anteater).

Look what may happen when an adult has damage to the prefrontal cortex:

- loss of some social skills – has arguments, overreacts
- tendency to make inappropriate remarks
- difficulty grasping the moral of a story
- loss of ability to plan ahead or to work out what the result of an action will be

How many of those seem to affect many teenagers? Do any affect you? Maybe you could blame your brain and that not-quite-developed prefrontal cortex.
TEST YOURSELF

Can you read emotions in other people's faces?

Look at this picture of someone's eyes. Around the picture you will see four options.

Choose the one which you believe best describes what the person in the picture is thinking or feeling. Think about it carefully. Then do the same for all the pictures. Some of them are harder than others – don’t worry if you find some difficult. It’s important to choose something for every picture, though, so if you really can’t decide, just make the best guess you can.

Practice

ANSWER: scared
relaxed  upset

surprised  excited

feeling sorry  making somebody do something

joking  relaxed

hate  unkind

worried  bored

feeling sorry  bored

interested  joking

remembering  happy

friendly  annoyed

angry  hate

surprised  thinking about something
kind 10 shy
not believing
bossy 11 sad
angry
confused 12 joking
sad

thinking about something 13 upset
excited
happy
thinking about something

joking

happy
excited

upset
happy
class

not believing

kind

relaxed

thinking about something

happy
class

not believing

kind

relaxed
made up her mind, joking

surprised, bored

angry, friendly

unkind, a bit worried

thinking about something sad

bossy, friendly

angry, daydreaming

sad, interested

kind, not pleased

surprised, excited

interested, joking

relaxed, happy
playful

surprised

joking

confused

kind

thinking about something

sure about something

happy

ashamed

not believing

shy

daydreaming

joking

nervous

ashamed

not believing

guilty

worried

relaxed

sorry

excited

pleased
Now see how many you got right.

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WHAT DID YOU SCORE?

This test was designed for children up to the age of 12. There is also an adult version, which you can find in Simon Baron-Cohen’s book *The Essential Difference* or on the Autism Research Centre website. They test the same things, and the pictures are the same, but the words used in the child version are easier and it is shorter. But the interesting thing is that no one has measured what would be normal results for teenagers. Why don’t you get some of your friends to take this test and see if they score better or worse than 10–12 year-olds?!

The normal score for 10–12 year-olds is between 18 and 23. If you score over 23, you are very good at this test. If you score below 18, you are not so good at this skill. But if you are aged between 13 and 17 and scored poorly, maybe, just maybe, you are a victim of your changing teenage brain! It might be nothing to do with that, of course, but it’s interesting to think about.

Acknowledgement: This test is called the “Reading the Mind in the Eyes” Test, “child version”. It was first published in the *Journal of Developmental and Learning Disorders* (2001) in an article by Simon Baron-Cohen and others, and is reproduced with the kind permission of Simon Baron-Cohen at the Autism Research Centre at Cambridge University.

Sleep – And Lots of It

“You can’t expect me to get up for school – I didn’t go to bed till two in the morning.”

Meet Sam, the teenager who can’t get out of bed.

Sam can’t get out of bed in the morning. Her dad stumbles into her room in his boxer shorts to wake her up. For the second time that morning. Her dad is disgusting; he smells of men’s sweat and his legs are white and hairy, and Sam hasn’t a clue how her mother can spend a night in the same bed as him. Fathers can be OK – from a distance, when they’ve showered, and only ever fully clothed. And when they have their wallets handy.

Sam didn’t hear her dad come into her room ten minutes ago. She didn’t hear him shout that she was going to be late for school, even though he distinctly heard a reply. Her younger brother is already dressed and is down in the kitchen feeding cereal to the dog. Her younger brother is disgusting too. He is twelve, spits, eats with his mouth open, leans over and breathes on her when she’s on the computer, puts his stinking feet on the sofa when she’s watching TV, picks his scabs and does