
THE LITTLE BOOK OF BIG STUFF ABOUT THE BRAIN

The true story of your amazing brain

THIS BOOK
IS ABOUT
YOUR BRAIN!



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*To living,
the only real experience*

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Foreword

To enhance public awareness of the benefits to be derived from brain research, the Congress, by House Joint Resolution 174, has designated the decade beginning January 1, 1990, as the "Decade of the Brain" and has authorized and requested the President to issue a proclamation in observance of this occasion.

Now, therefore, I, George Bush, President of the United States of America, do hereby proclaim the decade beginning January 1, 1990, as the Decade of the Brain. I call upon all public officials and the people of the United States to observe that decade with appropriate programs, ceremonies, and activities.

In Witness Whereof, I have hereunto set my hand this seventeenth day of July, in the year of our Lord nineteen hundred and ninety, and of the Independence of the United States of America the two hundred and fifteenth.¹

It was with these words that President George Bush opened the Decade of the Brain, a period of unprecedented collaboration, research and discovery focused on advancing our understanding of the human brain. (And it was these words, 'Mr Prime Minister. Thank you for being such a fine host for the OPEC summit' that President George W. Bush, thanked Australian Prime Minister John Howard at the opening of the APEC Summit in September 2007.)

¹ Presidential Proclamation 6158

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Since that time there have been many amazing discoveries concerning the grey matter between our ears, more so than at any other point in history. In fact, it is argued that 95% of what we know about the brain has been learned in the last 15 years or so. We have come a long way in the centuries since Aristotle was arguing that the heart was the centre of sensation and movement and even in the decades since Dr Walter J. Freeman was inserting an ice pick up through the eye socket of mentally ill patients to scrape away a bit of brain in his pioneering transorbital lobotomies.²

One of the key discoveries has been the extent to which we are able to 'grow our own brains'. That the actual physical architecture of our brains – the way our millions of brain cells are wired up together – is as a result of the experiences we have and have not had through our lives; nature and nurture working together to create something quite unique.

An example of the way our experiences mould our brains is found in research conducted on nine stringed instrument players and reported in *Science* magazine in 1995.³ Experiments with these professional musicians showed how more of their brain was being used to process information coming from the fingers on their left hands than in non-musicians. They had changed the way their brain

² *The Lobotomist*, El-Hai, Jack; John Wiley & Sons, New Jersey, 2005

³ Quoted in *Mind Sculpture*, Robertson, Ian; Transworld Publishers, London, 1999

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was working by the repetitive experiences they had had. What's more, when the researchers probed further to see where the 'extra' brain had come from they were not entirely surprised to discover that it had been appropriated from the area of the brain normally associated with the palm of the left hand. What's more, it was ascertained that 'what determined how big the left-hand brain area had become was how old they were when they began to learn their instruments'.

The brain's ability to be moulded is known as 'plasticity' and the younger we are, the more plastic our brain is. That doesn't mean to say that you can't teach an old dog new tricks because you can (if the dog isn't too arrogant to think it knows it all and can't be bothered to change). It's just that it is harder to do, as you have to unwire certain patterns and rewire your brain with new pathways.

And this is one of the great uplifting themes running through this book: that by understanding how you have ended up with the brain you have both as a member of the human race and as an individual, you can actually come to love it better, understand it more and even know how to get more from it should you wish.

And this latter idea, that you can change your mind – literally – is another of the great breakthroughs in our understanding of one of the most remarkable outputs of the human brain – intelligence.

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For a century the notion of intelligence has been linked to the idea of IQ. That you have an ‘intelligence quotient’ – your mental age divided by your chronological age multiplied by 100 and known as ‘g’ – that can be assessed, measured and recorded, that is fixed and God-given and by that you can know your station in life and your place in society. For a better understanding of the many flaws in the IQ-model of the world of human potential I recommend *The Making of Intelligence* by Ken Richardson from the Open University.⁴

Richardson points out that this original equation was developed by a Frenchman, Francis Binet, at the turn of the last century as way of ascertaining which children needed the most amount of educational support at school. The educationally beneficial aspects of this process were overlooked, though, by people such as Lewis Terman in the US who pounced on Binet’s work as a way of scientifically identifying ‘feble-mindedness’ in society in order to ‘preserve our state for a class of people worthy to possess it’.⁵

One of the greatest ironies of modern psychology must be the fact that a series of IQ tests Terman performed on a particular class of young students failed to identify not one but two future Nobel laureates in physics, Luis Alvarez and William Shockley. (Indeed, Shockley’s biographer describes his subject as ‘the living embodiment of the weakness of IQ tests’).⁶

⁴ *The Making of Intelligence*, Richardson, Ken; BCA, 1999

⁵ Quoted in *ibid*.

⁶ The rise and fall of William Shockley, *New Scientist*, 10 June 2006

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Another American psychologist, Henry H. Goddard, also used the new Stanford-Binet IQ Test for socially manipulative purposes. With waves of new immigrants arriving in the US daily, Goddard pressed for IQ testing stations to be set up at their point of entry into the country. Here, using IQ tests delivered in English through interpreters, he was able to identify that ‘83% of Hungarians, 79% of Italians and 87% of Russians were feebleminded’.⁷

What Richardson points out is the absurdly circular idea that the sorts of questions used in IQ tests were exactly the sorts of questions that children doing well at school would be able to answer. So, children doing well at school would do well in IQ tests and children who did well at IQ tests did well at school, thus proving how effective the IQ tests were.

As this book will show you – and as Dr Curran has pointed out elsewhere – there is a place for IQ testing but only as one element in a ‘battery’ of tests to help identify an individual’s strengths and weaknesses. Add to this the idea of multiple intelligence (Professor Howard Gardner’s theory that we don’t just have one way of being ‘clever’ but at least eight and probably more⁸); the notion that we can teach people to be clever (see the work of Reuven Feuerstein based in Israel and known as ‘instrumental enrichment’⁹) and our ability to ‘grow’ our brain and you

⁷ *ibid.*

⁸ *Frames of Mind: Theory of Multiple Intelligence*, Gardner, Howard; Basic Books, New York, 1983

⁹ *Changing Children's Minds: Feuerstein's Revolution in the Teaching of Intelligence*, Sharron, Howard; Souvenir Press, London, 1987

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can begin to appreciate that the most staggering thing about our brain is not what it is but what it can become.

But, before you plunge into Dr Curran's story of how your brain came to be let me take you back to the White House one more time.

President Clinton (that's former US President Bill Clinton, not presidential candidate/failed presidential candidate/President/Former President* Hillary Clinton) made himself a sticker for his fridge door during his campaign for re-election. It said, simply, 'It's the economy, stupid!' In other words, no matter how complicated and difficult things get, if he could remember to focus on this one thing alone then he would be OK.

In the work that I do with teachers around the world I urge them to do something similar for their staffroom doors, only this time the sticker should read, 'It's the brain, stupid!' Everything that goes on in classrooms, for better or for worse, is a result of activity between ears. And if you understand that, then no matter how complicated and difficult things get, you have a chance to do something about it.

And whatever role you have in life as you pick up this intriguing little book, the same rings true for you. Every act you undertake, every thought you entertain, every memory you hold, every hang-up you have, every quirk,

* Delete as appropriate

Foreword

foible, idiosyncrasy and knack, it's all the result of chemicals and electricity working across a network of soft organic matter that you have helped build throughout your life.

So, enjoy the story of your brain but remember, as someone once said, 'If our brains were simple enough to understand them, we would be too simple to understand them'.

Ian Gilbert
Suffolk

Introduction

all it takes is love

This book is about the brain. I hope however it is mostly about who we all are, or at least how we arrived at being the person we are now. It is extraordinary to me how much understanding of myself and how much hope flows from my ongoing study of how the brain works. And perhaps the most surprising message for me from looking through billions of dollars of research is that the most important thing you can do for yourself and for others is to love yourself and others for who they are, because by doing that you maximise the brain's ability to learn and unlearn.

This book is about that understanding. It is a book about structure and function – and the immensely reassuring fact that there is nothing occult or sinister or hidden about our emotional selves – there is just a whole pile of circuitry that can be adjusted and changed and remodelled as required.

I like to take a simple approach to life and try to find easy ways to look at complex problems. And for us as humans our own brain is probably one of the most complex things we are ever going to encounter. So this book is about trying to make that unbelievably complex set of connections and interactions and cells and chemistry into something that can be understood at the most important

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level of all – as a human being alive with potential and ready to change in the pursuit of growth.

The work underlying the hypotheses and ideas in this book started with a neurosurgical friend of mine in England about 12 years ago, and since then I have been adding (and subtracting) thoughts and concepts until the present book distilled itself out of the process. I have to say it is a work in evolution – ideas that I present in this book may very well be proven incorrect as further work appears from the many laboratories and theorists around the world who are so heavily involved in trying to understand our brains (with their own brains, which is a fascinating thought – the brain is the only organ in the body which we study with itself!).

In defence of this book however I would say that as I continue to read deeply within the scientific literature, I have yet to find anything that disagrees with the fundamental frameworks in this book. I am also encouraged by other sources of literature from outside hard-hatted science which also increasingly seem to support the most important message in this book – emotions and our emotional brains underpin everything we learn, and the more you have connected with another human being emotionally the more they can learn from you.

This is not a book about education in any narrow sense of that word. We are, in an absolutely fundamental way, an expression of how our brains are functioning. For every single one of us as human beings therefore to

Introduction: all it takes is love

understand how our brains work means we have taken another step towards understanding ourselves. There is also a wonderful sense of hope for me in understanding how our brains work. That comes from the fact that there is nothing about ourselves that we can't fundamentally change if we are prepared to do the work required. This means that no matter how deep the damage runs, there is still hope that it can (eventually) be unlearned – or at least diluted to a level where it no longer governs our lives. It is extraordinary to consider that we are, in every aspect of our humanity, from how we brush our hair to the deepest of our religious convictions, just sets of circuits firing to produce reactions in our bodies and minds. I say 'just', but of course this isn't a 'just'; this is a dance of unsurpassing beauty that chimes with the music of the heavens.

Let me just share with you a small piece of synchronicity that occurred while I was working on one of the original draft papers that represented the earliest stage of the ideas in this book. For quite a long time when I was preparing the draft, the title read 'How the Brian works'. It took me several months to spot the error – Microsoft Word spell checker of course does not recognise that the name Brian is not particularly grammatically useful in this sentence! The synchronicity was down to the fact that I have always been a huge Monty Python fan. If the supposition of this book is correct – that we all are the sum total of our brain in what we express as humans – then the seat of godhood is indeed, as so many religions

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believe, within each and every one of us, waiting to be found as we progress through life.

I would also like to say at this stage that the model of global brain functioning that I am describing in this book is to describe the vessel and not the spirit. I personally see the spirit as being separate from our human existence and do not attempt to try to understand something that I believe to be beyond the compass of the human mind. I would also say that this discussion is describing the anatomy and chemistry – that it is not in any way supposed to be a comment on all the functions of the brain.

That being said I hope that you really enjoy this book. It is supposed to be a relatively light-hearted look at brain functioning, though it is based firmly in the literature. As you will notice I have included a complete reference list with this work, and these papers and books would be available to everyone either through the Internet (where they will mostly be paid for) or through your local library.

Thank you for reading this.

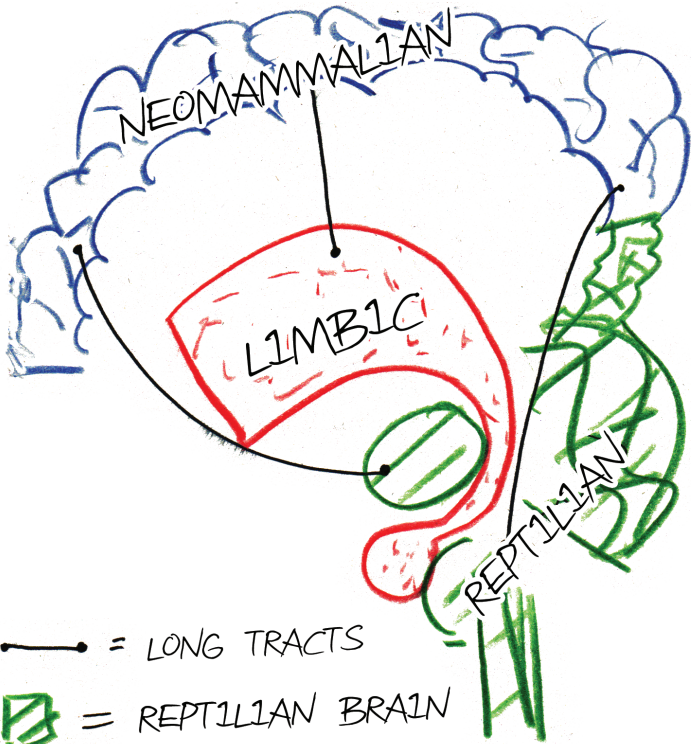
Chapter 1

where it all came from

So how can I start to share with you the amazing science behind the theories about your brain and how it works so that you can hopefully understand yourself better? I love stories, and for me all good stories have a beginning, a middle and an end. I plan therefore to start the story of your brain right back at the first beginning we can really get any handle on – the beginning of life as we know it (Jim).

A really, really long time ago when the first land dwelling life was crawling on probably 17 wobbly legs out of the primeval swamp, your far distant ancestor probably looked extraordinarily ugly and had all the thinking ability of a rather unpleasant, two-month-old wet sponge. In fact, that very early ancestor was very probably not something you would have wanted to take home to meet your mother.

Nature is of course interested in change and growth (by and large). So after another really, really long time the wet sponge gradually grew a nervous system (you have to have a nervous system if you are going to do any of the most basic functions – such as moving, eating, having babies, etc.). That nervous system (through a process of incredibly complex evolution) ended up as the deepest and most primitive part of your brain, the so-called



—● = LONG TRACTS

■ = REPTILIAN BRAIN

■ = LIMBIC (PALEOMAMMALIAN) BRAIN

■ = NEOMAMMALIAN BRAIN

THE TRIUNE BRAIN

Figure 1

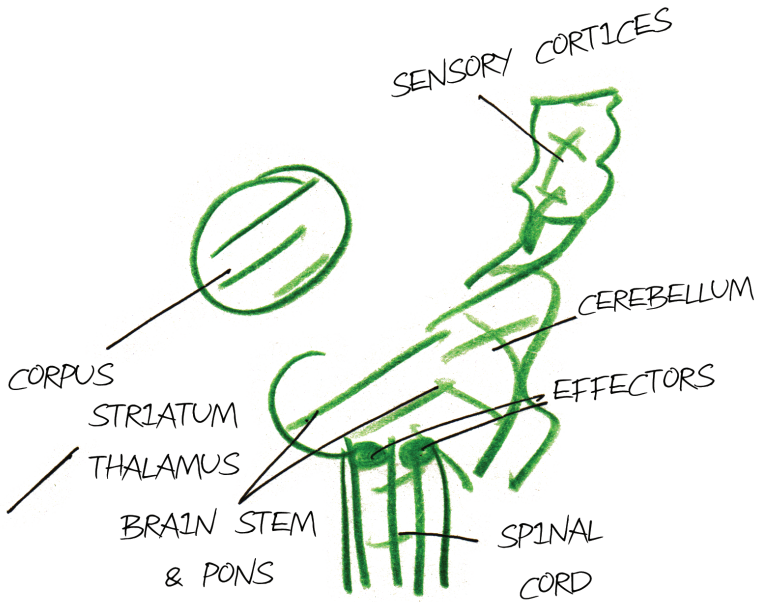
The deepest and most primitive part of your brain, the so-called *reptilian brain* (the green bit).

Chapter 1: where it all came from

reptilian brain (the green bit in [Figure 1](#)). This was the first step towards evolving what PD MacLean¹ has called the triune brain, the ultimate expression of which is seen in you.

The reptilian brain is a pretty simple soul ([Figure 2](#)) and is pretty poor at responding to novel situations.^{2:3} It represents the most basic form of complex higher nervous system evolution and had pride of place in the evolutionary tree about 400 million years ago. It sat in the heads of the immediate ancestor of the mammals (to which you of course belong), the birds, and those most ferocious of ferocious things, the dinosaurs ([Figure 3](#)). Its entire life aim was (and is) to preserve its own existence. It did this with little concern for any other life forms on the planet. This central need for self-preservation is of course a fundamental part of all our survival – the problem with lizards is that they do it as islands of individuality, not as functioning parts of a larger social group (which isn't a problem if you are a lizard, but is if you happen to be a human being!). And of course you still have a fully functioning, self-serving reptilian brain set deep into your brain.

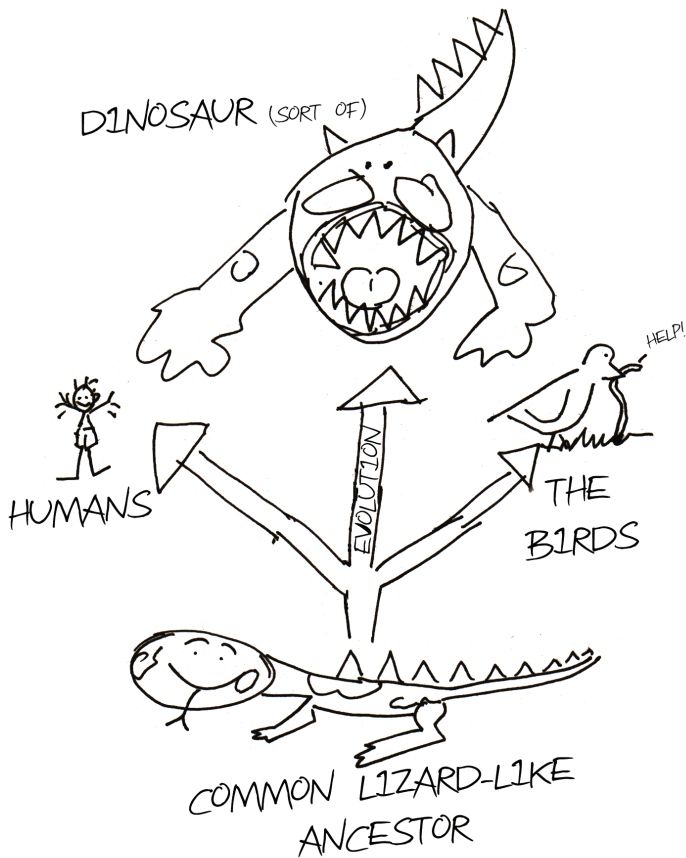
It has a set of relatively primitive structures that are essential for the basic needs of being able to move, smell and see. It also carries the central structures that keep your heart beating and your lungs pumping – pretty important really for staying alive! It is these structures that are irreversibly damaged in the tragedy of 'brain stem death' – which I am sure you have heard about on



THE REPTILIAN BRAIN

Figure 2

The reptilian brain is a pretty simple soul and is pretty poor at responding to novel situations.



EVOLVING FROM A
COMMON ANCESTOR

Figure 3

The reptilian brain sat in the heads of the immediate ancestor of the mammals, the birds, and those most ferocious of ferocious things, the dinosaurs.

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television and in films, if not in your own life. Finally, it has a primitive form of what in you has become your *amygdala*. This very early and primitive emotional structure is to do with what are called ‘flight or fight’ reactions, i.e. either run from whatever is threatening you – or hit it!^{4:5} The amygdala (of which I am going to tell you a great deal more later) also carries the centre(s) for sexual arousal.

Outside these essential but ultimately basic functions the reptilian brain’s ability to perform more complex tasks is extremely limited. In fact it is estimated that in its most highly evolved state (and the well reported example of this highly evolved state is the Mexican green lizard) this brain is capable of 27 different behaviours. These behaviours (whilst they might tax the brain of my uncle Thomas at three in the morning after a good Friday night feed of drink) are not complex and involve things like moving from the heat to the shade, from the shade to the heat, and finding water. The most complex behaviours that reptiles get up to are to do with active and passive stances (Figure 4).³ These are slightly more complex and involve a small lizard crouching down submissively when confronted by a large lizard, and the larger lizard standing up aggressively. This stops the larger lizard from attacking the smaller lizard and therefore wins as a top-notch survival behaviour. In human behaviour the very same thing still goes on – after all in every corridor of power exactly the same survival behaviours can be witnessed!

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is the user's manual that your brain didn't come with

What it is, how it works, what it looks like, where it came from – it's all here in this light-hearted and easy-to-read little book that will guarantee that you will never think about your own thinking in quite the same way ever again.

Whatever role you have in life, every action you undertake, every thought you entertain, every memory you hold, every hang-up you possess, every quirk, foible, idiosyncrasy and knack, it's all the result of chemistry and electricity working across a network of squidgy organic matter that you have helped shape throughout your life.

So, enjoy this little book about your amazing brain, but remember, as someone once said, 'If our brains were simple enough to understand them, we would be too simple to understand them.'

Dr Andrew Curran is a practising paediatric neurologist in Liverpool who is also committed to using his extraordinary knowledge of the workings of the human brain to make a difference in the educational experience of all young people. He's involved with Manchester University's Department of Education in developing research ideas looking at the use of emotional literacy in our classrooms.



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