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# Foreword

*The Brain's Behind It* began as a project in one millennium and was completed in another. It is an attempt to make sense of what science says about learning from the point of view of someone with little or no scientific training. It endeavours to separate facts, fallacies and fads and to identify scientific findings about learning that are of use to educators, parents and policy makers.

Some of the excitement of writing this book came along with an increasing realisation of my own ignorance as I wrote it. I had been caught up in some of the excitement of the brain-based learning movement and made some errors that I am now pleased to correct. The book is a snapshot of what I can find out about the science of the brain and how it relates to learning at this point in time. It is time to conclude. What I thought when I started is not what I think now. If I leave it much later, then my thinking will have slipped from me again.

The scientific activity I describe in this book considers what variables influence our capacity and willingness to learn. Some of the science felt familiar, some I have been persuaded of and some has come as a revelation to me. In the early pages I try to address head on some of the cherished but fallacious ideas that have fuelled what has become known as the 'brain-based learning' movement.

For the purposes of simplicity the use of the term 'learning' in this book is deliberately broad. It includes the idea of 'a permanent and improved change of condition as a result of activation'. Learning is often achieved through 'purposeful and distributed rehearsal'. Learning does not occur without activation at some level but that activation need not be consciously driven. Thus modelling and mimicry are included within my range of learning strategies. So too are distributed rehearsal, processing time, focused and diffused thought, demonstrating understanding through varied means and reflection.

When I use terms such as neuroscience in the book, I intend to include all those disciplines whose focus is the study of the brain. This is a caravan of many members. It includes those who work at the cellular level, who work with imaging studies, and who deal with clinical dysfunction. It does include neuroscientists, but I try to identify the work of cognitive psychologists separately. I do so for the purpose of distinction between the physical entity of the brain and what we can observe there, and the cognitive functions that its physical changes may lead to. Often brain and mind are confused in the literature of brain-based learning. Both are interconnected! They must be recognised as such, but there is a difference between observable physical changes and conclusions about related behavioural changes.

I have set out to examine factors that influence the development of the human brain and attempt to explain the notion of insult and possible damaging effects on learning capacity. The role of imitation and mimicry, and the importance of structured play are described in detail. The importance of multi-sensory engagement within sensitive periods seems to me as important in acquiring good learning attributes as does appropriate leavenings of emotional security. Stress is good for learning short term but disastrous beyond that. What happens in the brain with practice? Distributed rehearsal is at the heart of any performance improvement, and maybe the place of rote learning ought to be defined. Is all learning of equal value in the brain? Are some

experiences dependent and others expectant? If so, then all learning cannot be equal. What happens when we think mathematically? Are the same structures used for looking at pictures as looking at words? Is there a biology to aggression? What about attention? Can there really be a brain that has a deficit in attention? When we age what happens to memory? Would knowing about the degeneration of memory in ageing tell us anything about classroom learning? We are told that men are from Mars and women from Venus and that boys and girls have such different brains we ought to teach them differently. Should we believe these views? Finally, if you believe the self-help industry, it will tell you that your left brain is logical whilst your right is creative. Is there any truth at all in this? If not, then why is this myth so pervasive?

I hope to clear up some of these issues and if not, then certainly to put forward a well considered view. I cannot say with certainty if educators and brain researchers will ever be able to communicate meaningfully with each other. Perhaps this book will go a little way to furthering the dialogue.

When I had only just started to write this book, a good friend discovered that a tumour the size of a mandarin orange had lodged itself in her brain. She had just arrived on holiday in Vietnam. She was rushed by air taxi to Bangkok and within 24 hours she was operated on. The phenomenal skill of the surgeons saved her life but the prognosis remained gloomy. Some weeks later she was flown home to England and started her recovery. Radiation therapy followed. It was unsuccessful. She had another lengthy and invasive operation. Chemotherapy followed. Again, unsuccessful. This time the operation scooped out what remained of the tumour and some of the secondaries. On recovery, there was some loss of mobility. Movement has since begun to return as health is restored. It would appear there is success. Fifteen months later and she is in the gym with a fixed smile that her friends recognise is uniquely hers.

It is impossible from a distance to begin to get a sense of what fifteen months of hope given and removed, of pain and distress, of constantly having to be positive for yourself and for others must be like. It is equally hard to appreciate the skill of the neurosurgeons from around the world in operating again and then again with finer and finer margins and with higher and higher levels of risk. The skill of the surgeons who helped Lorna is built on the accumulation of hundreds of thousands of hours of dedicated research into the workings of the human brain. Some, but only some, of which can be described within the pages of this book. I hope that this book whets your appetite to find out more, to support those whose lives are devoted to furthering our knowledge of the brain and its workings, and to try some of the ideas advanced within the book.

The final thing to say is that I am an educationalist first and foremost. My scientific knowledge and training has been acquired in much the same way as the Victorian amateur. If at any time I am guilty of 'phrenological' thinking, then it has arisen as a consequence of enthusiasm rather than hubris. I have tried throughout to triangulate the evidence so it has more than one voice of authority behind it. Where there are omissions I take consolation in knowing that brain science is indeed a developing science but some of the greatest brains are behind it.

Alistair Smith  
February 2002

# How to use this book

## The organisation and structure of the book

This book is organised so that it is easy to navigate through. Hopefully it facilitates different ways of reading. It sets out to be of interest to parents, educators and policy makers. It provides an overview of existing scientific research into the workings of the human brain starting with fallacies and fads. This is followed by a body of factual information from which a set of findings and specific recommendations emerge. Throughout the book the fallacies, fads, facts and findings are kept separate.

The introduction poses the question, 'Can brain research tell us anything about learning?' It then attempts to identify a number of especially virulent fallacies and fads.

Parts One and Two are more factual and lead in to Part Three, which contains the findings. Each chapter in Parts One and Two is broken down into clearly headed sections and is preceded with a summary and a set of questions by section.

Part One is called 'Wired: the development cycle of the learning brain'. It is organised as a crude time line of the brain in development.

Part Two is called 'Ready, wire, fire: a model for the learning brain'. It is organised to demonstrate how brain science can be linked to formal learning. The chapters address topical issues.

Part Three is called 'The brain's finally behind it'. It contains a set of findings that arise from the book and separate sets of recommendations for parents, educators and policy makers. Part Three also includes an extensive list of questions and where to find answers in the book, recommended websites and a detailed glossary of terms used. A bibliography is organised by section.

## Different entry points

The human brain is complex, multi-faceted and highly adaptable. So are you. In respect of this, you are provided with a variety of routes through this book. You can, if you choose:

- ✂ start at the beginning and work through.
- ✂ start with the fallacies and fads. These are listed in the introduction.
- ✂ go straight to the findings and recommendations. These are to be found in Part Three.
- ✂ obtain an overview via the illustrations. There are over 60 and they are positioned carefully within each chapter to provide a distillation of the key learning points.
- ✂ obtain an overview via the chapter summaries. Each chapter is preceded with a set of summary points by section.
- ✂ start with the questions. These are found at the start of each chapter and are collected together in Part Three.
- ✂ start with keywords or topics. These are provided in the index at the back.
- ✂ put it on a shelf to gather dust. Promise yourself that you will get round to reading it one day.

# Chapter 1

## Introduction

### Can brain research tell us anything about learning?

Within the space of two months I attended two events that addressed the question, 'Can brain research tell us anything about learning?' One was in London and the other was in San Diego, USA. They both conveyed fascinating insights into what is fast becoming the 'brain-based learning movement'.

The event in London was a one-day symposium held at the Royal Institution. It was formal, carefully orchestrated and consisted of neuroscientists presenting their position followed by educationalists presenting theirs. Arguments were carefully made, positions were summarised and discussed and the audience invited to comment. It all took place in the very lecture theatre where Faraday and Davy had, in the eighteenth century, demonstrated their scientific discoveries. It was very British.

The Brain Expo took place at the Paradise Point Resort, San Diego, California. It was very different from the symposium in London. On the first morning 300 delegates warmed up by doing the dance of neural networking. Whilst a presenter demonstrated at the front, we were all encouraged, and found ourselves willingly agreeing, to simulate various neural structures. I was lifted off my seat as I quickly became a myelin sheath. The woman next to me was being DNA when she should have been potentiating at the synapse. As the hysteria rose, I thought back to the wood panelling of the Institution in London and wondered what the suited academics would have made of all of this. How readily would they have 'got collectively down' to the neurotransmitter boogie, if at all?



1.1 We are all neurologists – or are we?