

Introduction

I read my first book about the brain when I was a school inspector, and I immediately wanted to read all that I could understand about neuroscience and brain studies. The reason for this compulsion was because my time as a teacher was plagued by notions of learning as a set of polarised arguments – ‘look-say *v* phonics’, ‘progressive *v* traditional’ and other dichotomies. These debates created something of a battleground, where both pupils and their teachers were the losers. As I read more about the brain, I realised that our understanding of learning could one day be partly based on science, as the evidence from neuroscience would provide the datum for a science of learning. This could lead to a broad consensus as to what learning is about and enable teachers to enjoy more public support for their work.

The nineties of course was the decade of the brain and there were great expectations developing as to what brain studies might offer in the future. However, at present the evidence from neuroscience that informs learning is like a huge and only partly-formed Roman mosaic; incomplete yet fascinating. New research about the brain is coming in thick and fast, and in time I am convinced it will have a powerful influence on theories of learning. Already there are major strands of evidence that are having an impact by creating a sea change in our understanding of how learning evolves and develops through our earliest experiences. This book aims to investigate how our understanding of learning, and therefore of teaching, is changing.

The quality of an individual’s life, and therefore to some extent the quality of life in society, is directly linked to the experience of love, supervision and support of early childhood. The foundations of learning and intellectual development are established at the same time and from the same roots. Evidence from brain studies is helping us to understand how children grow, learn and develop from dependent infants to fully functioning adults. It is becoming clear that successful adults owe a great deal to their thoughtful and caring parents and other caregivers, and studying the brain in the earliest stages of life sheds light on why this may be so. A major theme of this book is that formal schooling should as far as possible be married to the experience, skills, knowledge and talents that children bring into school with them.

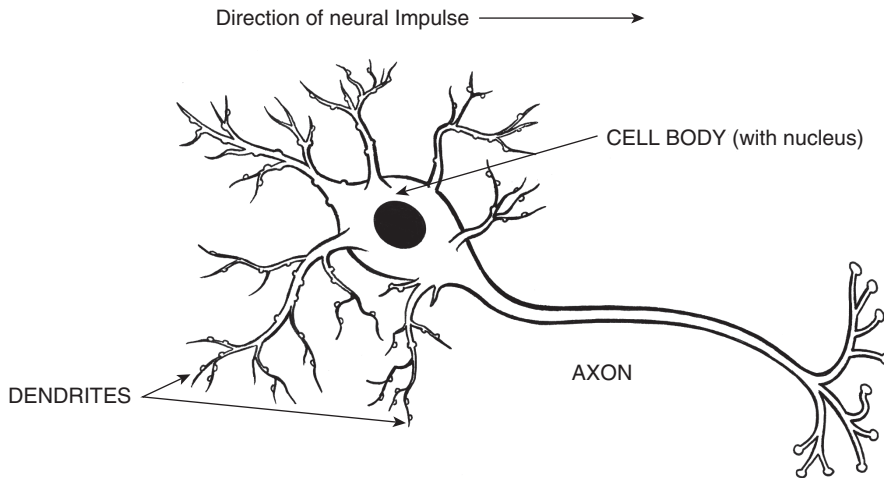


Figure 2.1 A typical neuron

unique features. The first is that the outer layer is designed to convey nerve signals as electrochemical pulses, and the second is that each cell has projecting parts called dendrites (from the Greek term meaning 'branch') acting mainly as receptors.

Other features of neurons include the axons, which carry signals away from the cell, sometimes a long distance away to other neurons. Many axons have an insulating sheet of myelin, a fatty substance, which helps them to transmit messages faster. Most of the incoming signals to the cell are received by the dendrites which have tiny bumps on them known as dendritic spines. The dendrites are so numerous that they represent 90 per cent or more of the cell's surface.

In addition to the neurons, there are glial cells which have many functions. Mainly they serve to support the neurons, helping to cleanse, carry nutrients and assist in repair. Until recently it was thought that these were their only functions, but there is now the suggestion that they may play a role in intelligence.

Almost all the neurons in the brain are generated well before birth, mainly in the first three months of pregnancy. An adult brain as mentioned previously has around 100 billion brain cells, which is close to the number we are born with. There is something paradoxical here though. Children's brains are actually much busier than ours

3

Pay attention and get connected!

In the five sections of this chapter we consider different aspects of attention, and examine evidence from research in this fast-growing field of study. Here you will learn more about:

- why attention is essential for intellectual development and how it causes the brain to create connections;
- barriers to attention in a technological age, and the problems for some children with watching television;
- the importance for children of being physically active to develop their brains and evidence of the impact of technology on children's performance;
- the discovery of mirror neurons and the importance of first-hand experiences for sensory, and therefore brain, development;
- moving to school, drawing on evidence about attention that affects how children join school and make progress.

The chapter ends with a consideration of attention as the new formal discipline underpinning learning through the pioneering work of the neuroscientists Posner and Rothbart.

No attention – no learning!

The notion of paying attention has always been seen as important by teachers. Now neuroscientists are beginning to explain why it is so vital

Life dependency

In summary, at this stage:

It is the emotional availability of the caregiver in intimacy which seems to be the most central growth-promoting feature of the early rearing experience. (Mortimore, 2006)

Similarly, Krystal (1988) concludes that:

the development and maturation of affect-feelings, represents the key event in infancy. (Schore, 1999)

It is hard to overestimate how important these early processes are for the whole of a person's life.

The non-verbal, pre-rational stream of expression that binds the infant to its parent continues throughout life to be a primary medium of intuitively felt affective-relational communication between persons. (Orlinsky and Howard, 1986)

These observations about the importance of the mother-child relationship should give us serious pause for thought, especially in light of the large increase in the number of very young mothers. For example, in one London borough between 1995 and 1997 there were 89 conceptions per 1000 girls aged 15 to 17. Taken with the evidence in this chapter, it seems of the highest importance to provide every support for these young women in order that they many fulfil their role with an understanding of the subtle yet vital nature of the mother-infant relationship. In fact, the whole issue of maternity needs higher status. One recent survey of 5000 mothers found that 20 per cent of them felt unsupported during labour, and a high percentage complained of 'poor quality, depersonalised care' (Elliott, 2007). Support for young mothers is thus a crucial issue for both the present and the future.



Point for reflection

The evidence illustrating the essential nature of the relationship between mother and child for both wellbeing and brain development cannot be ignored. How can this information be made available in sensitive and responsible ways that do not increase the levels of guilt that some mothers already feel?

Working memory

There is no overall consensus among theorists on the ways to classify memory, but one area of agreement is the distinction between short- and long-term memory. Short-term memory is now more generally known as working memory, as it registers what we need to know to function in the present. Raley describes it as:

the mental glue that holds connections together, as we think a thought or enact a process from beginning to end. (Raley, 2001)

Long-term memory is encoded and put into more permanent storage in the brain, requiring the growth of new synaptic connections.

Working memory is an essential part of what it is to be human. It enables us to act in particular ways and to make choices and decisions from minute to minute. Perhaps its importance is seen most clearly when it is impaired, as for instance in patients with Alzheimer's who are unable to function independently because of the loss of their working memory. Current evidence shows that a working memory system starts to develop in infants between six and twelve months and shows protracted development throughout childhood (Johnson, 2005). Kandel (2006) points out that the main difference between long-term and working memory is time-related: working memory operates over minutes or perhaps hours, while long-term memory spans days to years.

Pupils in school will retain the task that they have been given in their working memory, while they process the requirements of the task and carry it out. Holding three or four task components in the memory is easy for some pupils, but problematic for others, and those for whom it is a particular difficulty may need additional help to develop their working memory. This, along with practice in attention, forms a set of sub-skills that are essential for learning, and in some cases they need to be taught discretely.



Point for reflection

Are there any of your students who have difficulty with holding information in their working memory, particularly when they have to remember verbal instructions for a task? If so, what strategies might be helpful for them?