Chapter 1

BRAIN DEVELOPMENT, NEUROSCIENCE AND PSED

This chapter is a reconfiguration of the chapter about 'brain development, neuroscience and supporting staff' in my book *Performance Management in Early Years Settings* (Garvey 2017). In essence, the two chapters are very similar; the Early Childhood, Care and Education (ECCE) sector is giving wider recognition to research, and developing understanding of the importance of brain development in our work with young children, and I wanted to explore this from two very different angles. In my previous book, I considered how early childhood practice could support leaders and managers in working with adults. For the purpose of this book, and this chapter, I am going to consider how some knowledge and understanding of brain development can support adults in understanding and supporting personal, social and emotional development (PSED) in early childhood.

There are ground-breaking discoveries being made in a range of areas, such as Biology, Neurobiology, Neuroanatomy, Neurochemistry, Neuroscience (and branches such as Cognitive Neuroscience, Behavioural Neuroscience, Social Neuroscience), Developmental Psychology (which explores changes in humans and cultures over time), as well as Cognitive Psychology (which considers areas such as learning, thinking, memory and perception). This rich diversity of research means our understanding and knowledge of human brain development is expanding rapidly. For example:

> The first few months after birth, when a child begins to interact with the environment, are critical to human brain development. The human frontal lobe is important for social behavior and executive function; it has increased in size and complexity relative to other species, but the processes that have contributed to this expansion are unknown. Our studies of postmortem infant human brains revealed a collection of neurons that migrate and integrate

> widely into the frontal lobe during infancy. Chains of young neurons move tangentially [loosely] close to the walls of the lateral ventricles and along blood vessels. These cells then individually disperse long distances to reach cortical tissue, where they differentiate and contribute to inhibitory circuits. Late-arriving interneurons could contribute to developmental plasticity, and the disruption of their postnatal migration or differentiation may underlie neurodevelopmental disorders. (Paredes *et al.* 2016, p.81)

In other words, what Paredes and the team found is that during the first few months of life, babies' brains are physically still being formed as not all of the neurons are in the correct place at birth. They also suggest that some of the routes the neurons have to take are 'treacherous', and that their role within their destination of the frontal lobe (cortex) is to help support the 'balance [of] the brain's need for stability, with the ability to learn and change' (Weiler 2016). To me, this very new area of research generates a whole barrage of questions, not least as to how we best support parents and our very youngest children, but also how this research has huge implications for anyone interested in early childhood. The research also raises concerns regarding other influences on such young brains during this sensitive period, such as neurons that are 'late arrivals' and possible 'disruptions' along the journey. Again, this has huge implications for those of us interested in early childhood, which could perhaps include some of the areas we will consider in Chapter 2, as well as other issues for consideration elsewhere in this book:

> The first months of life, when an infant first begins to interact with its environment, is a crucial time for brain development, Huang said. 'The timing of this migration corresponds very well with the development of more complex cognitive functions in infants. It suggests that the arrival of these cells could play a role in setting up the basis for complex human cognition.' (Weiler 2016)

All of this new and ground-breaking research and scientific understanding adds to our growing knowledge and understanding in early childhood. Therefore, throughout this book, there will be opportunities to consider various aspects of research and how this may be beneficial to us as adults in terms of how we support personal, social and emotional development, and behaviours, in early childhood. However, it is then understandable that when faced with such huge amounts of new material coming from a variety of different angles, there can be some confusion.

Brain Development vs Neuroscience vs Psychology

It is perhaps useful, at this point, to clarify the terminology that will be used in this book. Much has been written about the use of 'neuroscience' to influence policy and practice, and whether indeed this has been correctly used and interpreted. Della Sala and Anderson (2012) talk of 'neuromyths' and cite Landau (1988), Bruer (2000), Goswami (2006), Purdy (2008) and Fischer (2009) as places to go for further reading. They offer one perspective on this ongoing debate:

> …while the use of 'neuroscience', is attractive in education it seems to us the 'cognitive psychology' does all the useful work or 'heavy lifting'… There is indeed a gap between neuroscience and education. But that gap is not filled by the 'interaction' of neuroscientists and teachers (nearly always constituted by the former patronizing the latter). (Della Sala and Anderson 2012, p.3)

Regardless of external debates, I believe that the term 'neuroscience' is well-known in ECCE, however it is being used. Much of the knowledge I have gathered is an amalgamation from across all the disciplines discussed, and I suspect that is the case for many of the practitioners working in the ECCE sector. In my head, I see this range of theories, knowledge, understanding and even debates, under the encompassing umbrella of 'neuroscience'. If you are interested in this debate, there is a range of information on this in the bibliography, if you wanted to explore this further. I was discussing this with Professor of Neuroscience, Francis McGlone, who suggested we could use the term 'cognitive neuroscience':

> *Cognitive neuroscience* is the scientific field that is concerned with the study of the biological processes and aspects that underlie *cognition* [thought, reasoning and learning], with a specific focus on the neural connections in the brain which are involved in mental processes. (F. McGlone, personal communication, 2 March 2017)

Many people interested in early childhood are interested in the function of the brain, and how it works. We are interested in the 'changes in humans and cultures'. We are interested in 'learning, thinking and memory', and how this supports our work with children (and, perhaps, adults too). Therefore, I believe 'neuroscience' is a word that is accepted and understood in the early childhood field to mean 'the science of brain development'. I do not want to overcomplicate or confuse matters further, therefore, it is with the widest meaning and understanding, as discussed here, that I will refer to the term 'neuroscience' throughout this book:

> Neuroscience has traditionally been classed as a subdivision of biology. These days, it is an *interdisciplinary* science which liaises closely with other disciplines, such as mathematics, linguistics, engineering, computer science, chemistry, philosophy, psychology, and medicine. (Nordqvist 2016, emphasis added)

The science of the function and development of the brain (neuroscience) is a developing one, and therefore only slowly revealing its secrets. This means there is much debate in and around the areas of neuroscience as to *how* important the early years are:

> The best chance to turn this around is during the *1001 critical days*. At least one loving, sensitive and responsive relationship with an adult caregiver teaches the baby to believe that the world is a good place and reduces the risk of them facing disruptive issues in later life. (All-Party Parliamentary Group 2015, p.5, emphasis added)

In 2002, the Organisation for Economic Co-operation and Development (OECD) published a report and came up with the term 'neuromyths':

> The genesis of a neuromyth usually starts with a misunderstanding, a misreading and in some cases a deliberate warping of the scientifically established facts to make a relevant case for education or for other purposes. (OECD 2002, p.71)

The OECD report *Understanding the Brain: Towards a New Learning Science* is worth a read, to anyone interested in neuroscience and early years. Not least because it challenges our thinking. I do not want to get into too much of an academic debate about neuroscience, and whether or not the early years are 'vital', 'windows of opportunity' or 'sensitive periods' – terms which are bandied about in any article, journal or book with any vague connection to early years and neuroscience.

> Despite all this intense research, the brain is so very complex that our knowledge, despite constant new technologies, is rudimentary and highly conjectural. No one has any kind of overall theory about how the brain works. So it is hardly surprising that, as yet, neuroscience does not add up to a coherent explanation of how we think and become the way we are. (Penn 2014, p.87)

To explain this debate in simple terms, the dispute comes when some people try to use existing research to *prove* that it is *only* the first three years of life that count. This argument implies that any learning and development cannot happen after this, or indeed that any 'damage' cannot be repaired later – and this is simply not true. (Think about learning to drive, or adults

overcoming a fear of, say spiders, for example, which is well after the first three years of life!) This is usually referred to as 'brain plasticity', meaning the brain's ability to change. What is acknowledged and generally agreed is that the early years are important, and as those of us interested in early childhood know only too well, we can make a difference:

> This means that the best time for shaping brains is during the early years, before the age of three. This doesn't mean that it's all over by three years. The brain continues to develop until the early twenties, and even then, it still has massive capabilities to change and adapt. But, the brain will never again adapt as quickly and robustly as it does during the early years. (Zeedyk 2014b)

I do, however, want to acknowledge that this debate is very relevant and very real, and one, that in early years, we need to be aware of. Much of the understanding of brain development comes from work undertaken on and with animals, or posthumously on human brains. Additionally, our understanding and knowledge of human brain development is still evolving. Furthermore, we need to continue to be curious, inquisitive and challenge assumptions. In other words, don't believe everything you read…check out the research, consider what you know and observe about young children and challenge when what you see and hear does not appear to make sense.

Bearing all of this in mind, and for the purpose of this book, I am going to use the term 'sensitive periods', and we know that a child's early years are a sensitive period in terms of development. I feel this recognises the debate and the neuromyths agenda, but also acknowledges the importance of the early years as a whole. In terms of nurturing PSED and understanding behaviours, I feel the following quote is helpful:

> A fundamental paradox exists and is unavoidable: development in the early years is both highly robust and highly vulnerable. Although there have been long-standing debates about how much the early years really matter in the larger scheme of lifelong development, our conclusion is unequivocal: What happens during *the first months and years of life* matters a lot, not because this period of development provides an indelible blueprint for adult well-being, but *because it sets either a sturdy or fragile stage for what follows.* (Shonkoff and Phillips 2000, p.5)

Brain Development

Scientific (and indeed medical) research tells us that the brain is a complex organ, of which only a small amount is understood, and new discoveries are continuing to be made.

> Since Paul McLean suggested in 1970 that there was a 'triune' brain, or three-brains-in-one, there has been general recognition that the brain is structured by evolution, starting with a reptilian brain, on top of which developed a mammalian emotional brain, and finally a human neocortex. (Gerhardt 2015, p.51)

There is still much debate amongst neuroscientists and neuroanatomists as well as other scientists from a range of disciplines about the exact makeup of the brain. For example, it is now widely accepted that many reptilians have some form of developed cortex, and that some cells in the limbic system react to the position of the head and not just emotions. For example, Najafi *et al.* (2017) are offering 'a large scale network' rather than one area or the 'emotional brain'. They go on to say:

> Although research on the brain basis of emotion has often focused on particular brain regions, the investigation of associated larger-scale circuits is growing at a considerable pace. This is not only the case in human research with fMRI but also with genetic and molecular techniques that afford increasing control and enhanced monitoring of neuronal populations in non-human animals.

Furthermore, we need to be careful that we do not always say 'oh, that's the mammalian brain' or use the example of 'gut reactions' of the reptilian brain purely as an excuse for certain behaviours.

> One final problem with the triune-brain model is that it treats the brain as if it were organized along strict hierarchical lines. Just because the cerebral cortex is where conscious thought takes place does not mean that it sits at the top of a pyramid and controls all the lower levels of the brain. On the contrary, some deeper structures in the brain (the brainstem in particular) exercise significant, continuous control over activity in the cortex – for example, by modifying the synchronization of its neurons according to whether the individual is asleep or awake. (The Brain from Top to Bottom 2012)

I am also conscious that many of us interested in early childhood are not scientists (me included), but we have to have some language we can use, without overcomplicating the subject. Therefore, it is with this understanding in mind, that I will use the terms:

- the brainstem (sometimes referred to as the reptilian brain)
- the limbic brain (sometimes referred to as the mammalian brain)
- the neocortex.

It is of course always useful to keep up to date with current thinking and new discoveries, and acknowledge that what means something to one person (or discipline) may mean something completely different to someone else – or indeed may even be considered outdated. Therefore, for the purpose of this book, I think this language is something we in early childhood can feel comfortable with, can work with, and have some level of understanding of, at this moment in time. I acknowledge that this is a very simplified version of neuroscience, but this is only intended to be an introduction and an overview to brain development and exploration of how this knowledge can support practice in the early childhood field. In addition to this I will explore the theory, evidence and research regarding the function and role of the Reticular Activating System (RAS) Filter, sometimes called the Reticular Formation.

I recognise that these areas of the brain do not operate in isolation, and have a complex network of connections, synapses and neurons that influence and support each other. Many medical and academic descriptions, as well as a range of terminology, are available to consider the various parts, areas and functions of the human brain. If you are looking for further information on this, the websites 'The Brain from Top to Bottom' or the 'DANA Foundation' are perhaps useful places to start. Additionally, I was delighted when Dr Suzanne Zeedyk agreed to write the foreword for this book. Suzanne's work of bringing science to the public is hugely accessible and understandable, and further details of where to look can be found in the bibliography.

Furthermore, the help, support and guidance I have received from Professor Francis McGlone has been exceptionally valuable. His help, support and vast knowledge of the neurosciences and associated fields has been incredibly useful. I would urge anyone interested in this area to look at research by Professor McGlone and continue to keep a watchful eye on the media for his name.

Additionally, anything written by Sue Gerhardt is very readable, interesting and easily relatable to ECCE practice (with adults, as well as with children). The hugely influential, often quoted as a 'leadership' book*, Emotional Intelligence* by Daniel Goleman, also has a whole section dedicated to the emotional development of the human brain, and is equally helpful. Interestingly, although Daniel Goleman is often quoted in terms of leadership, much of his work is actually about understanding PSED, and Emotional Intelligence in children:

> Perhaps the most disturbing single piece of data in this book comes from a massive survey of parents and teachers and shows a worldwide trend

> for the present generation of children to be more troubled emotionally than the last: more lonely and depressed, more angry and unruly, more nervous and prone to worry, more impulsive and aggressive. (Goleman 1996, p.xiii)

Alternatively, if you prefer watching to reading, Allan Schore is a researcher in the field of neuropsychology. Often described as the 'American Bowlby', Schore has numerous publications as well as some easily understandable videos on YouTube. There are, of course, numerous other writers and researchers (see the bibliography section) and as you look into this subject more, you will find favourites that you find helpful (or not) as the case may be.

There is also new research appearing almost daily, which just goes to prove how much there is still to discover about the workings of the brain. What is known, and is fairly easy to understand, is that it is the nervous system that carries the messages around our brains and bodies, and that the nervous system transmits information gathered from the five senses.

The Importance of the Five Senses

Let us consider how information is received by the brain; this can only happen by use of one of the five senses:

- sight
- hearing
- smell
- touch
- taste.

One, or more, of the five senses has an 'experience' and this information is channelled through the nervous system into the spinal column and up into the brain. This is why the ECCE sector acknowledges, champions and demonstrates the importance of children learning through experience. ECCE practitioners provide a range of experiences that enables, empowers and encourages young children to explore their world by what they see, hear, smell, taste and touch. For example, very young babies begin to learn, almost from birth, by putting things into their mouths; interested adults provide safe ways for babies to develop this. Hand-held toys, sensory baskets and heuristic play are all examples of open-ended resources that allow babies to explore. As babies grow, adults respond to the growing senses, for example, by offering foods that allow exploration of new tastes, smells, textures, etc. and, similarly, understand that not everything will be liked on first offering.

However, in terms of PSED, how often are lunchtimes rushed and stressful (for adults as well as the children), and simply a part of the day to be completed as quickly as possible in order to clear away and tidy up and move on to the next thing? Imagine though if this happened to you as an adult. How would you feel if you had to rush your evening meal because someone was determined to clear up as quickly as possible? How would you feel if your meal time consisted of someone constantly telling you to sit still, sit up, behave, stop talking, etc.? Sadly, this is the reality for many children, and we will explore this further in Chapter 3.

In terms of PSED, it is vital for adults to consider how we are supporting children to engage with all of their senses. If we know that it is the senses that carry messages to the brain, then how do we support children to use those senses in order to learn, develop, flourish and thrive? Some children will respond more strongly if their sense of smell is engaged, while for others it may be their hearing. Therefore, practitioners are finding innovative ways of introducing lavender or music into settings, for example, in order to facilitate a calming atmosphere for the children. As we know, children learn by doing, exploring, copying, taking risks, making mistakes, repetition and so on, and the messages children's brains are receiving, via their five senses, are full of interesting and exciting things to explore, learn about, be intrigued by, be inspired by and feel valued by. In other words, we offer a range of ways for supporting the Characteristics of Effective Learning (Early Education 2012, p.5). In this way, children are supported to learn and develop, they are encouraged to explore their world through their senses and messages can then travel further into their brains.

Reptilian Brain (Brainstem)

The reptilian brain, is as its name suggests, largely equated with the functions of the brains found in early primitive reptiles. It sits close to the top of the spinal column, at the base of the brain. In simplistic terms, the reptilian brain controls our bodily functions and our responses to what is happening around us (especially danger). The reptilian brain needs food, warmth, sleep, routine and people who help it to feel safe, and once all these things are in place the reptilian section of the brain feels secure. We know the importance of this for children, but do we always consider how the reptilian brain may well be causing the reactions/behaviours we see in children? How often are children 'accused' of being 'naughty', when actually they are tired, hungry, cold or even afraid? Imagine the scenario if an adult was treated in this way.

REFLECTIVE PRACTICE: CASE STUDY

Reptilian Brain Behaviours

You are running late for work. You have slept badly due to a head cold. The boiler was not working, and therefore you did not have any hot water. You accidently dropped the last of the milk and so have not had breakfast. The roadworks on the High Street caused the bus to be late and now you have run the five minutes from the bus stop and have arrived at work, out of breath, hot and sticky, slightly apprehensive and a little grumpy.

As you arrive at the building, there are lots of parents and children and other staff around. You run down the corridor to get to the lockers as quickly as possible, in order to get into your area as soon as you can.

Suddenly your manager comes out of the office and shouts: 'We do not run inside. Please walk nicely.'

Consider the above scenario:

- How would you feel?
- How do you think your reptilian brain would be feeling?
- How often do we do/say similar things to children?
- Considering this now – how does that make you feel?

It seems ridiculous when put into this context, and we will explore this more elsewhere in this book, but this (and similar examples) happen to children all the time, and it happens a lot. It is acknowledged that this and similar situations are not intended to cause stress, fear, hurt and anger and so on – but that does not help the poor reptilian brain…

In early childhood, it is well recognised that the needs of the reptilian brain are vital for children's wellbeing, learning and development. Children who are cold, hungry, unsure what will happen next, or untrusting of the adults or the environment, for example, are *unable* to learn, develop, flourish and thrive. Therefore, ECCE practitioners, by having regard to each 'unique child' and developing 'enabling environments' and 'positive relationships', are supporting the young reptilian brains in their care to feel safe, and ensuring that 'Development Matters' (Early Education 2012) for each child.

However, do we *actively* and *consciously* consider the needs of the young reptilian brain? Do we stop to think 'is this child cold/hungry/frightened/hot/tired', etc.? Or do we move straight into almost 'blame' mode – and react to stop the child behaving/acting in a particular way? Imagine the

scenario of being late for work; how different would that feel if your manager turned and said 'hey, you look a little frazzled, go sit down for a few minutes and give yourself time to breathe'? I am sure that the majority of us do give children 'time to breathe', but I am also sure that unintentionally we also shout 'we do not run inside' (or similar well-intended phrases) without thinking about what the reptilian brain might be experiencing, or without considering other factors that may be involved.

For example, are we aware of the potentially stressful encounters the small reptilian brains may have already experienced before they even enter, or arrive at, our settings? The reptilian brain needs to feel safe and secure in order for it, and the rest of the brain, to function correctly, yet, sadly, we will have all supported children who, for a variety of reasons, are struggling to feel safe and secure. Sadly, many children face issues or 'other factors' that influence their brains. Therefore, we offer protection, warmth, love and affection, and do our utmost to ensure, that with us at least, children have the safety and security they so desperately need. In other words, we build strong, respectful and trusting, as well as positive, relationships. We build caring and supportive environments where each child can be unique. However, we do not always know which children need additional support in order to feel safe and secure. We do not always know which children are frightened by our environments, for example. Are we aware of the children experiencing difficulties at home? Or, consider the children you know, the ones who perhaps cannot talk yet, or the ones who are quieter, or the children perhaps with Special Educational Needs or Disabilities (SEND); how do we support the PSED of these children? How do we ensure the reptilian brains of these children feel safe and secure?

You have probably noticed the obvious and intentional references here to *Development Matters* (Early Education 2012), and the highly effective triumvirate of:

- Unique Child
- Enabling Environments
- Positive Relationships.

These well-regarded, familiar and highly effective areas of early childhood practice are the bedrock of our beliefs in how children learn, develop, flourish and thrive. We quote them and refer to them constantly, but do we consider them in relation to brain development? Do we consider how each unique child, the environments we provide and the relationships we form have a direct impact on how children's brains develop and, indeed, react?

The Fight, Flight or Freeze Response

One of the main roles of the reptilian brain is to decipher the many millions of pieces of information received constantly, and highlight any that may be about to cause a threat. The reptilian brain's response to a threat is to help our brain decide on the most appropriate course of action to keep it safe: whether it is a case of fight, flight or freeze. Consider how animals behave when they are scared, perhaps when sensing, or coming across, another animal who may see them as food. They have three basic options:

- Fight: is there any possibility of being bigger or stronger than the perceived threat?
- Flight: is there any possibility of out-running the perceived threat?
- Freeze: is there any possibility of standing completely still and not being noticed?

So, for example, a deer, meeting a lion, would very quickly decide that winning a fight is probably out of the question, flight could be a possible option, if there is enough open space to out-run the lion, or maybe standing still against the trees and hoping not to be noticed is the best choice. The analogy of a 'rabbit caught in the headlights' is useful here. Rabbits often freeze in terror and seem unable to run away to safety when suddenly finding themselves on a road at dusk, and facing an oncoming car.

In terms of humans, the response is similar. With young children, when they meet a real or perceived threat, they work out the best response: fight, flight or freeze. Consider toddlers finding their way in an ECCE setting and trying to understand group dynamics, for example; some will fight, some will choose flight and some, just like the rabbit in the headlights, will freeze in terror. Additionally, at different times, the same toddler may try any or all of the responses to see which is the best option. The question to ask ourselves here is – do we as adults recognise these reactions as the reptilian brain response?

Now let us consider adult responses to threats, which also can be real or perceived. The key here is to understand, that as mammals (human or otherwise), there is rarely a considered, thoughtful or measured response in these situations. It is usually a primal instinct, driven by the reptilian brain to ensure safety. Dr Suzanne Zeedyk (2013) talks of the metaphorical fear of 'sabre-toothed tigers' and the primal instinct to stay alive and not be eaten.

As already discussed, the brain's response to threats is unconscious, but there is also a physical (or physiological) response to fear, which is also beyond our control. Imagine walking alone down a dark street late at night, you hear footsteps behind you. Your heart starts to beat faster, your mouth

goes dry, your pulse quickens, your muscles start to tense, you start to sweat and your breathing becomes faster and shallower, and so on. Within a split second your brain has perceived the threat, moved your body into a state of high alert and considered whether to fight, flight or freeze, all without you making any conscious effort… And this response is the same in children who are afraid, worried or anxious, whether or not that fear is real or perceived.

In today's modern world, as Zeedyk (2013) rightly points out, although there are no 'sabre-toothed tigers', there are however other threats, both real and perceived, that cause the brain to react in much the same way as it would have done in primeval days. Parents, practitioners and leaders and managers in the early childhood world spend a huge amount of time trying to ensure threats (both real and perceived) are minimised for children, wherever possible.

One way in which we consciously do this is through Observation, Assessment and Planning (OAP). Practitioners continuously observe children, and consider why they are responding (or should we say – behaving?) in the way they are to a given situation or experience, then plan and action any interventions or responses accordingly. There is no 'magic wand'; this is about knowing individuals, and putting in place a range of strategies that will help children feel safe and secure. The question here is – is Observation, Assessment and Planning seen as a way of supporting brain development (and indeed helping children feel safe) – or just more 'paperwork we have to do'? (And we will explore this in more depth in Chapter 5.) Additionally, do we consider the 'unconscious' ways we react? The throw-away line, such as 'we do not run', or how we support the child who is desperately trying to stay so still and quiet as to not be noticed?

The world can be a scary place, whether you are a deer meeting a lion, a rabbit caught in the path of a fast car, a toddler trying to understand the world or, indeed, an adult worried about being late for work. In terms of the reptilian brain and PSED, our role is to support children to feel safe, in order that learning and development can take place. But before that can happen, we then also must navigate the emotional part of the brain.

The Mammalian Brain (Limbic Brain)

In this section, let us explore what we know about the importance of the limbic brain/mammalian brain in terms of the work we undertake in early childhood. Oxforddictionaries.com define a mammal as:

> A warm-blooded vertebrate animal of a class that is distinguished by the possession of hair or fur, females that secrete milk for the nourishment of the young, and (typically) the birth of live young.

Science tells us that the limbic area of the brain (in some form) is present in all mammals, hence the term mammalian brain. So, this links back to my experience with my two cats, who as mammals have some form of 'limbic brain'. As I discussed in the introduction I am fairly certain my two cats show emotion in some way, and there is research around this with other mammals too. Indeed, as mentioned previously, Charles Darwin's *The Expression of the Emotions in Man and Animals* from 1872 is a fascinating read. Additionally, the majority of the research we have and understand *is* from work based on medical research and observations on animal behaviour and animal brains. Whether we agree with this ethically, morally, personally, or not, is not a debate for here. Agreeable or not, the fact remains that this is where the basis of our knowledge comes from. Phelps and LeDoux (2005), in their article 'Contributions of the amygdala to emotion processing: from animal models to human behavior', offer a comprehensive overview on how this area of science has developed:

> Although studies in humans cannot explore the neural systems of behavior with the same level of specificity as research in nonhuman animals, identifying links in the neural representation of behavior across species results in a greater understanding of both the behavioral influence and neural representation of emotion in humans. (Phelps and LeDoux 2005, p.184)

In other words, science cannot (at least at the moment) fully explore functioning human brains, for obvious reasons. However, it is possible to use the research gathered elsewhere to develop our understanding of behaviours and emotions in humans. This, along with developing technology and new research with humans, is allowing us to learn more than ever before:

> Contemporary non-invasive neuroimaging methods have provided developmental scientists with the opportunity to track safely, cognitive and neural processes underlying human development. (Casey *et al.* 2005, p.104)

The mammalian brain is also known as the limbic area, and is in the very centre of the brain and cocooned or 'ringed' on all sides, and therefore difficult to access, in terms of research on 'live' subjects. As Goleman (1996, p.10) explains, it is 'called the limbic system from "limbus" the Latin word for ring'. And we know we still have much to learn. Rajmohan and Mohandas (2007) suggest:

> There is no universal agreement on the total list of structures, which comprise the limbic system. (Rajmohan and Mohandas 2007, p.132)

Whether the structure of the brain is universally agreed, or not, is not hugely important at this point. What is important, and is universally agreed, is the

function that this part of the brain undertakes. The limbic system is the main area where emotion, memories, self-esteem, sense of identity and belief in ourselves are developed, and where the need for touch and affection is located. It is also widely acknowledged that the 'emotional mammalian brain' developed *before* the 'human thinking neocortex brain'. I particularly like Goleman's description of this. Perhaps this quote is one that should become as concrete and well known in PSED/human development as the nursery rhymes we sing from our own childhoods:

> The fact that the thinking brain grew from the emotional reveals much about the relationship of thought to feeling: there was an emotional brain long before there was a rational one. (Goleman 1996, p.10)

This knowledge of the interactional relationship between feelings/emotions and learning/thinking is well regarded in early childhood. We also know what happens when this relationship fails or is damaged. The damage caused by a range of factors and influences such as poverty, war, famine, abuse, discrimination, lack of interaction and attachment and so on, are ones that practitioners in early childhood ever strive to counteract. In ECCE, a great deal of emphasis is placed on strategies, activities, relationships, environments and so on, that support this area of the brain, and we recognise the importance of these areas of practice. In early childhood, these are often collectively highlighted under one category of PSED. Whilst it is acknowledged that PSED is not exclusively developed in the limbic brain, there is a direct correlation. In terms of early childhood, in recent years, this greater knowledge has resulted in elevating the status of PSED to a higher prominence than ever before, and rightly so. The importance of developing and supporting this middle part of the brain is well researched, documented and implemented into daily practice with young children. PSED is highly regarded as the key area that forms the foundations for all other areas of learning and development. In other words, the functions of the limbic brain are seen as hugely important in early childhood, but do we consistently put these understandings and beliefs into practice?

Let us consider this from an early childhood point of view: a child who has just turned three years old has been with you in your setting for a term. There is pressure to move the child into the preschool room, as there are more parents wanting places for their soon-to-be two-year-olds. The key person expresses concern that they have just started to build strong relationships with the parents, the child has only had one term to settle, and that the child is still struggling with understanding of the general routines, the environment and building friendships with peers.

Hopefully, in any effective setting, serious, thoughtful and compassionate conversations will take place, where the needs of the child will be considered. In other words, it will be the personal, social and emotional needs of the child that are at the forefront of any discussions. However, in some cases this will not happen. The business case will, understandably, have to be accounted for, parent pressure for the child to move up 'to be ready for school', etc. will all 'weigh in' to the argument, and in the middle of this, the child's voice can be lost. Once the move has taken place, will consideration be given to the various responses of the brain of the child, and therefore any reactions to the situation? Or once again, even unintentionally, will it be that the default 'blame' mode takes over? Let's consider how this could feel as an adult.

REFLECTIVE PRACTICE: CASE STUDY

Mammalian Brain Behaviours

After three months in a new job, you are told by your manager that you are moving areas at work. You are needed in another section and will be moving next week. You explain that you have just started to develop relationships, get used to the routine and have only really just settled in. Your manager downplays your concerns and says 'you'll be fine, just be a big girl/boy, you'll love it, they have so much fun in the other area'.

Consider the above scenario:

- How would you feel?
- How do you think your mammalian brain feels?
- How often do we do/say similar things to children?
- Considering this now – how does that make you feel?

Again, as in the Reptilian Brain Behaviours case study, this seems ridiculous when phrased like this, but this is often what happens to very young children. In terms of PSED, do we actively and consciously consider how our actions/words impact on children's feelings? Do we stop to consider the various areas and needs of the brain, and therefore the unconscious reactions we will then inevitably see in the child? On the whole, I am sure the child will be supported, but I also suspect that at times young children are told to be 'a big boy/big girl' and their emotions unintentionally dismissed, and we will explore this further throughout the book.

The mammalian part of the brain is the section of the brain that as adults we often find ourselves at a loss to describe, decipher and understand. For many humans, talking about emotions is, in and of itself, difficult. Our thinking brain struggles to find the appropriate words to describe how we feel, and equally we struggle to find words that will be acceptable to those we are talking to. In other words, we are worried that the words we use will cause an emotional reaction in others. For example, we struggle to discuss what we believe maybe contentious issues with our own friends, partners, family and the colleagues and families within our workplace. Additionally, we sometimes find our emotions taking over, and perhaps we behave in more impulsive ways than usual. Daniel Goleman describes this:

> In a very real sense we have two minds, one that thinks and one that feels… One, the rational mind, is the mode of comprehension… Thoughtful, able to ponder and reflect. But alongside that there is another system of knowing, impulsive and powerful, if sometimes illogical – the emotional mind. (Goleman 1996, p.8)

In essence, in ECCE, we praise the features of PSED, we shout loudly of the importance of children being supported, we explain to others why PSED is so important and then in the next breath complain that children are 'misbehaving', rather than referring back to our extensive knowledge and understanding of how brains work. In other words, we forget the emotional needs of the brain. Consider, then, the children and adults you know; are children and adults treated differently when they are experiencing emotions?

REFLECTIVE PRACTICE

Understanding Influences on Behaviours?

Consider your career history:

- Thinking about children, how are children supported with their emotions? How are children treated? Is this consistent – and if not, why not?
- How do adults usually react to children's emotions?
- What messages does that send to children?
- Now consider adults: how are adults supported with their emotions? How are adults treated?
- Are the adults and children treated differently – why do you think that is?