CHAPTER 1

DEVELOPMENT FROM CONCEPTION TO 3 – NEW UNDERSTANDING

Keys ideas explored in this chapter

- new research evidence and current thinking that can inform ECEC practice
- the need for early years' practitioners to be secure in their understanding of normative development
- factors from conception and through the first months of life that may affect long-term development.

Valuable research from a number of disciplines including psychology, medicine and education now supports our understanding of the importance of factors in early development in relation to long-term outcomes for children. The Early Years Framework states: 'It is during our very earliest years and even pre-birth that a large part of the pattern of our future adult life is set' (Scottish Government, 2008: 1).

The development of non-invasive scanning techniques now enables medical researchers to monitor and analyse development and brain activity from conception and from birth (Goswami, 2008; Huotilainen, 2010). Researchers and academics in the fields of psychology and education continue to use this 'hard' evidence to theorise and develop understanding of how children develop and learn and how best adults can educate and care for them.

Trevarthen and Aitken (2001) identified that children exhibit the essential motivation for learning in the first months when they actively seek to engage in proto-conversation with a main carer. A proto-conversation is the interaction pattern between mothers (usually) and babies where the mother speaks when their baby stops babbling, or when the mother finishes the baby's 'conversations'. Babies begin to 'read' facial and vocal emotions and clearly favour their mother tongue. For an infant to survive and develop to their full potential, the caregiver must provide emotional attachment but also the opportunity for active engagement with the environment.

Normative development

All children undergo an orderly and predictable sequence of neurological development and physical growth considered as normative development. For example, physical development involves first lifting the head, then rolling over before sitting up unaided and then standing and walking. These are developmental 'milestones' that all children pass through in the same order. However, each child is unique and will pass these at different ages. There are milestones for all aspects of development and it is important for all ECEC professionals to be familiar with these. If you have not already done so, it is a good idea to start by studying the physical developmental milestones and then working through all aspects such as cognitive, social, etc. and then looking at how development in one area can impact on another. For example, development of the pincer grip (bringing the thumb and fore-finger together) around eight months enables the child to manipulate tools, providing greater independence and the ability to make marks. This has an impact on cognitive development (Bruce and Meggitt, 2006).

A knowledge of the expected developmental 'milestones' helps us in a number of ways, including:

- allowing us to expect a stage to be reached within a particular time span
- allowing us to identify potential problems and address these early – notice anything unusual, particularly any developmental delay
- allowing us to provide appropriate challenges and a suitably stimulating environment.

Development is the interplay between the unique genetic blueprint for each individual and the unique experiences each has from conception. Parents will naturally draw on their own experiences and, often, subconsciously follow the model laid down by their

own parents. If a child has experienced a childhood lacking in affection, support and stimulation from adults, they may recall and replicate this model, which in turn may promote a cycle of deprivation. Alternatively, an adult may completely reject a bad model of parenting; for example, the child of an alcoholic who abstains from alcohol. Bruce (2004) highlights how early theorists such as Freud and Erikson suggested that an appropriately stimulating environment combined with stable relationships positively supports development. A wide body of current research confirms this.

The Tickell Review (2011) draws from international research to support what early years practitioners had already identified, namely that 'foundations laid in the first years of life, if weak, can have a detrimental impact on children's longer term development' (p. 2). It is important that ECEC professionals reflect on their own experiences from childhood and parenting, as well as professional experience, to determine the influences on their own practice. Ongoing critical self-evaluation against an understanding of normative development and influencing factors is key to developing good reflective practice and will allow ECEC professionals to intervene early to support the needs of each unique child.

REFLECTIVE ACTIVITY

A case study considering normative development

An only child, Edward is 4 years old and has been in nursery since he was 3. His mother is Thai and his father is British. Dad works full time and mum works evening shifts at a local supermarket. When Edward walks for any length of time, or runs, he does so on tiptoe, not on the heel and ball of his foot. The nursery team is becoming concerned as his physical development does not seem normal.

How would you approach the parents to address this problem and what suggestion would you offer?

Discuss with colleagues or other students and then see the response at the end of the chapter.

New understandings

Pre-natal development occurs during the 38 weeks from conception, between the point at which the egg is fertilised, and birth. It is difficult to comprehend that within 38 weeks one egg will develop into at least 100 trillion cells and become a unique human being. One third of a million babies emerge daily into the world ready to face a range of challenges.

Our understanding of child development continues to grow and research and study no longer rely on observations. Development can now be mapped using new technologies which allow us to gather images during gestation and from the functioning brain. Goswami (2008) identifies three techniques appropriate to studying brain activity in children:

1 Electroencephalography (EEG)
2 Functional magnetic resonance imaging (fMRI)
3 Functional near-infrared spectroscopy (fNIRS)

There are advantages and disadvantages with each technique. The advantage of using fNIRS is that a young child need not be exposed to the large chamber associated with fMRI. However, according to Goswami (2008), fNIRS does not, at present, offer temporal accuracy comparable to EEG, or spatial accuracy comparable to fMRI. To record foetal and neonatal cognitive abilities, Huotilainen (2010) has effectively developed the use of magnetoencephalography (MEG), a non-invasive technique which records the magnetic fields produced by the active neurons in the brain. This experimentation has identified that during the last trimester (the final stage of pregnancy) and the first months of life, both emotional recognition and language acquisition develop rapidly. Cognitive abilities start to develop prior to birth, and the newborn has advanced abilities related to processing emotional information and speech sounds so that the foundations of native language acquisition and social skills are firmly in place (Huotilainen, 2010).

It is interesting to consider what an 'infant' is at this point, or rather how 'infancy' is defined. The word infant is derived from the Latin 'infans' meaning unable to speak, covering the period from birth to 2 years. Even this term indicates how human development is closely linked to the ability to communicate. The infant may lack the ability to communicate verbally, but these research methods indicate that the building blocks for language are initiated during neonatal development. *In utero* growth and development can now be closely monitored. Understanding how these very early experiences may result in different responses to later experiences in young children and have repercussions throughout their life, could help parents and ECEC professionals support children better.

Brain development

The term 'tabula rasa' (blank slate) is the epistemological theory that individuals are born without built-in mental content and that their knowledge comes from experience. Huotilainen (2010), through her research, asserts that the neonatal brain is already a product of development, not 'tabula rasa' but a highly capable organ. The foetal brain *in utero* has high levels of plasticity and most neurons are present by the seventh month following conception (Rakic, 1995). At birth we have all our neurons. We do not need and do not grow any more but we do need to connect them up. The more connections

there are, the better the brain will function. From six months to a year, the brain can make the most rapid neural connections and growth and this is facilitated by biochemicals generated by the intense social bond with the primary caregiver (Gerhardt, 2004).

Babies' brains develop as a consequence of their relationship with caregivers (Gerhardt, 2004; Szalavitz and Perry, 2011; Zeedyk, 2006). Forming and reinforcing connections between the brain cells or *neurons* are the key tasks of early brain development which is partly determined by the genetic code, but is then supported and influenced by relationships and the environment. Neurons make connections with others across the gap between them called the *synapse* in a process called *synaptogenesis*. Neurons that make successful connections remain, whilst the brain rids itself of those that are unsuccessful in another process called *synaptic pruning* (Doherty and Hughes, 2009). The brain develops in relation to the world, and once the key pathways are established, they remain and are carried into adulthood (Zeedyk, 2006). Early intervention should be interpreted as the 'earliest possible intervention' in order to establish the pathways that enable the child to learn and go on learning to reach their full potential. It would be wrong to suggest that *only* very early intervention will effect change as connections do continue to be made throughout life, as evidenced by the examination of Einstein's pickled brain by researchers in Canada. They found that the part of the brain involved in maths reasoning and visual-spatial thinking was 15 per cent larger than the brains of other men of comparable age (Gerhardt, 2004). We do however have clear evidence that earlier interventions are more effective.

We may have lost some of our intuitive survival skills over the millennia but a newborn baby has not. One area in the Highlands of Cameroon encourages their children to retain one of the early reflex actions. All newborns have the innate ability to take steps when a few days old but in our society this reflex action is lost and re-learned when the child starts to walk. The Cameroon mothers carry their children long distances in order to work and they need their children to be able to walk as early as possible. From about one month old, they encourage the children to 'make jump', which involves holding the children's arms, making them stand and bouncing them on their legs to strengthen the leg muscles and build and reinforce pathways within the brain. This reflex action has survived and does not need to be relearned so by 7 months most children are walking, not just with tentative baby steps, but surely and steadily. Children walking so early seems remarkable to us and demonstrates how neurological pathways are developed within the brain, creating synaptic connections.

Kotulak (1997) suggests that the principle 'if you don't use it, you lose it' is as true for cognitive skills as it is for muscle development. A newborn baby can swim at birth and some mothers allow their babies to swim unaided early on. Whilst it is not suggested that ECEC professionals throw babies into swimming pools or force them to walk, these examples suggest that neurological pathways can remain established and develop sooner given the necessary environment, rather than being 'pruned' out and then re-learned later.

The infant brain needs to form connections that will allow the child to survive; therefore the primary sensory systems need to be established first and these are the auditory, visual and motor systems. The areas of the brain dealing with higher-order association will mature later (Casey et al., 2005). Many pregnant women can recall a time when their baby seemed to be reacting to an auditory stimulus. This is frequently one that is musical or contains some type of melodic rhythm. The neonatal auditory system is capable of detecting small changes in frequency and has the potential to detect differences in the formant frequencies that separate vowels from each other (Dehaene-Lambertz and Baillet, 1998). This would indicate that neonates have the ability to note that some syllables follow one another whilst others do not; such skills are highly important for native language acquisition. ECEC professionals can support development through the use of singing, rhyme and rhythm (see Chapter 4 where the Kodály approach is discussed to promote language acquisition and support other developmental areas).

All babies are born with a range of mechanisms at their disposal to learn, but it is the adult's role to provide a range of suitable experiences. The plasticity of the immature human brain allows new pathways to develop through interactions with fellow humans. Researchers now believe that as much as 80 per cent of the basic brain architecture is 'wired' by the age of 3 (Kotulak, 1997).

This 'wiring' begins in the womb and is most rapid in the first months of life. The non-invasive research techniques discussed above have identified that children are building synaptic connections in the brain during the last trimester of pregnancy, linked to auditory development. The foetus will have listened to the mother's voice and other sounds whilst in the womb so that the infant at birth has already tuned into its mother's voice and therefore its native language. Newborn babies are programmed to search out human faces (Johnson et al., 1991), possibly an early survival technique; when a close bond is made, the chance of being cared for and protected will be higher. A baby is born as a learner and certainly does not wait to reach school to make a start!

Goswami (2008) has identified three types of learning:

1 Learning by imitation
2 The ability to connect cause and effect – explanation
3 Associative learning – analogy

Babies from birth to three days have been shown to be able to imitate gestures such as tongue protrusion and mouth opening after watching an adult carry out the same gestures (Meltzoff and Moore, 1983). This is despite the fact that a newborn does not even know what the object is that it is copying or comprehend that it has a face of its own! This ability to learn by imitation supports the development of social cognition. Developing social skills from an early age allows us to integrate into our culture. All human contact, whether it is with a parent, sibling or key worker, offers opportunities to imitate. Without such a close bond, this type of learning would not occur, as has been shown in children who have been isolated from human contact. Research into the impact on brain

development and learning of the harrowing experiences of Romanian orphans constantly left, sometimes tied in their cots and unable to form any kind of relationship, shows 'a virtual black hole where their orbitofrontal cortex should be' (Chugani et al., 2001, cited in Gerhardt, 2004: 38). Within the Maori culture, siblings and children tend to care for younger children and this may offer better opportunities to learn through imitation as children are far more animated in how they talk and move (Barr and Hayne, 2003).

REFLECTIVE ACTIVITY

Where the opportunity arises, observe a young baby's interaction with a slightly older child and consider these interactions: the body language, how the child uses language and the response from the baby. Compare and contrast a similar interaction between an adult and a baby. How does the adult's behaviour change?

The majority of UK nurseries working with children aged 0–3 accommodate them in relation to their specific age, so all babies up to the age of 1 are in one area. Consider the activity above and how children interact. Consider whether it would be better to accommodate them in family groupings so children can learn from each other. Family groupings might offer children more challenge. This model will be discussed further in the section related to Swedish daycare but it is interesting to note that during our own research, students commented on this structure and how it had made them question the often rigid division into classes in school by age.

> I think … it is restrictive … I think children are social and learning is social and that it's so valuable for younger children to learn from older children and vice versa and having one age group together can really limit their experiences, their opportunities … (Primary 1 teacher reflecting back on her 0–3 placement)

CASE STUDY

Euan is 1 year old and has a baby gym with lots of equipment for developing fine motor skills, such as pushing buttons, turning etc. and he can predict cause/effect reactions there. He has imitated his parents and grandparents in operating this equipment and also 'tried' to learn by trial and error. He is also able to use learning by analogy and found, for example, the push buttons on the phone/TV remote control. At 1 year old, he was only interested in

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pushing buttons to see what was happening. Now – at 20 months – he knows that the mobile phone is something that you talk on – and *imitates* a conversation when holding it to his ear – after pushing the buttons!

The case study of 'Euan' demonstrates the difference between imitation and analogy. Imitation is when the child has observed an action of another person and then copies the action, whereas analogy is something that the child has learned (perhaps by imitation or trial and error) and then can transfer to a new situation.

Young children demonstrate the ability to connect cause and effect. They constantly ask questions, and it is this questioning that supports the development of early memory. Young children also clearly have the ability to learn that certain events co-occur; this is referred to as associative learning. A baby makes the link that, 'if I cry someone will pick me up and soothe me and feed me'. This early example of associative learning is another basic survival technique.

Perris, Myers and Clifton (1990) demonstrated that six-month-old babies could retain memories of events for a very long time. Their research identified that at the age of 2 and a half, a child had retained a memory of a single event that occurred when they were six months old. Again, such child memory retention potentially has major implications for the carer. If a child has been subjected to a traumatic experience at an early age, this will be stored but the ability to actually retell this event later in life may not be possible, as the event could be buried deep in the child's memory.

External factors that affect the developing foetus

In utero, a foetus may be exposed to a range of damaging substances. These are referred to as 'teratogens' and include drugs, caffeine, alcohol and diseases such as genital herpes, mumps, rubella and HIV. Even expectant mothers who are aware and responsive to advice about dangers may expose the developing child to risks because of unknown factors beyond their control or even due to conflicting advice (Bing-Chen et al., 2010).

Drugs and alcohol can directly affect the developing foetal organs and restrict overall growth. When discussing drugs, we generally consider illegal substances; however certain long-term medications such as drugs for epilepsy do need to be administrated and monitored during pregnancy. With continual improvement in medical intervention and increased survival rates of individuals with previously life-threatening conditions, there is an increase in the number of mothers with conditions that previously would have precluded them from giving birth. There may be a

connection between emotional behavioural disorders or learning difficulties presented and factors such as mothers taking prescribed drugs, illegal drugs or excessive alcohol. This is an important factor for ECEC students and professionals to consider in terms of the impact on the development and learning of children in their care.

Hanson et al. (1976) studied women with severe chronic alcoholism and identified foetal alcohol syndrome (FAS). This presents as a range of physical and cognitive malformations in children. Their work was linked to that of Lemoine et al. (1968) who reported on a series of 127 offspring of chronic alcoholics from 69 different families, which noted:

- peculiar faces – smooth philtrum – the groove between the nose and the upper lip flattens
- considerable retardation of growth in height and weight
- increased malformation to organs such as the heart
- psychomotor disturbances – this means the development of skills that involve both mental and muscular activity does not progress normally and might present as lack of control over voluntary movements or bodily functions.

The authors identified that such children failed to thrive after birth. Similar patterns are observed in newborns exposed to harmful drugs, suggesting that withdrawal symptoms are occurring. Hanson et al. (1976) suggested that women should avoid consuming alcohol whilst pregnant and although many years have passed, unfortunately the consumption of alcohol, particularly in women, continues to rise.

In the first 12 weeks of foetal development, the central nervous system is established and an excessive intake of alcohol can be particularly damaging. In the last 30 years, consumption of alcohol has increased and the culture of binge drinking may contribute to FAS, particularly when women are unaware they are pregnant. Some factors related to FAS, particularly the impact on brain development during gestation, may explain the increase in a range of behavioural problems within care and education today. The effects can go beyond the physical and early impact during gestation to affect the mother and baby relationship or 'bonding' and long-term emotional development (Ostera et al., 1997).

What we see today are foetal alcohol spectrum disorders (FASD) ranging from mild learning difficulties through to birth defects. In the UK, it is estimated that 6,000 babies per year are born with FASD, with alcohol-related birth defects (ARBD) which may range from mild to severe, depending upon the amount of alcohol exposure and during which trimester the exposure occurred. It is possible that Attention Deficit Hyperactivity Disorder (ADHD) may be another effect of foetal alcohol exposure and research is ongoing into this (NOFAS, 2011).

FAS and FASD have been frequently under-diagnosed and under-reported. In Scotland, for example, there are more than 900 children (0–18) who have FAS with many more, possibly thousands of, children damaged in a more subtle way. The

effects of FAS/FASD cannot be repaired and may result in adults with long-term learning difficulties and/or anti-social behaviour preventing them from gaining employment, or they may be involved in substance abuse or addiction. There are obvious long-term socio-economic effects. The immediate negative impact on a young child's ability to learn can have an adverse effect on life chances (Children in Scotland, 2011).

Stress is a 'condition' we have in our daily lives and pregnancy itself can be a stressful time for some women (DiPietro, 2004). The mother's emotional experiences during pregnancy can affect the development of the baby's brain (O'Donnell et al., 2009). Stress causes increased levels of the hormone cortisol which can pass through the placenta. Neurologists have identified that the presence of this 'stress hormone' during gestation disrupts brain development and functioning, and it has been suggested it may result in a range of behavioural problems, especially attention problems (Clavarino et al., 2009).

ADHD is the most commonly diagnosed childhood psychiatric disorder, with an estimated prevalence of at least 4 per cent (Brown et al., 2001). Rodriguez and Bohlin (2005) concluded from their research, undertaken in Sweden, that pre-natal exposure to both stress and smoking (nicotine) were independently associated with later symptoms of ADHD in children, especially boys. As young children by nature are highly active, ADHD is difficult to diagnose. What actually causes this condition is a complex combination of genetic and environmental factors (Rodriguez and Bohlin, 2005). What has been identified through magnetic resonance imaging (MRI) is that the frontal lobes of the brain in children exhibiting ADHD are damaged, and this area of the brain is linked to the way in which we are able to control our behaviour (Kelly et al., 2007).

Stress continues to be an important factor after birth as babies cannot manage their own cortisol. Infants who are in a distressed state will produce higher levels of this hormone, rather than the relaxed hormone oxytocin, and in a stressed state an infant has a reduced capacity to engage with the world around them. The influence of this stress hormone can also have long-term effects on the overall development of the brain (see Figure 1.1). As adults, we have developed strategies which alleviate stress but babies have not developed the required skills to deal with stressful situations.

Habits or automatic responses are being formed and physically embedded by the production of certain chemicals in infancy and it takes until about 4 years old to establish a normal adult pattern of high levels of cortisol in the morning, lowering later in the day (Gerhardt, 2004). Detailed research shows how love and attention, particularly from the key carer (usually mother), critically from six months to a year, reduce stress and stimulate the development of the 'social brain' (2004). Research shows that infants of depressed mothers appear less responsive to faces and voices as early as the neonatal period (Field et al., 2009).

Whilst it may not be possible for ECEC professionals to impact on this early period of life, knowledge and understanding of the antecedents of a child's behaviour can inform

practice to better support the needs of individuals. It can also support practice in more general ways in terms of ensuring consistency of care, establishing key workers for each child, and highlighting the importance of being responsive and creating a calm environment.

Figure 1.1 demonstrates the effect of *global neglect* (this means severe neglect, including sensory deprivation) on the developing brain. A vast amount of stimulus and support is required to try to reconnect some of the neural pathways before they are permanently pruned out.

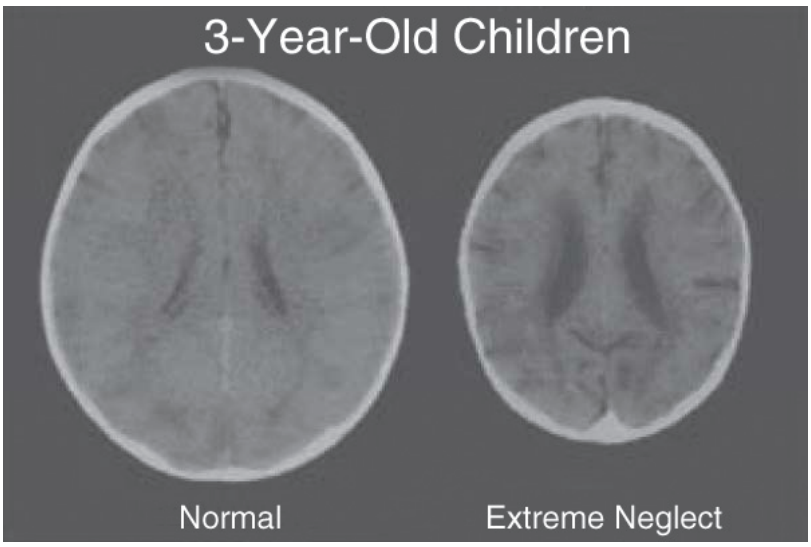

Figure 1.1 These images illustrate the negative impact of neglect on the developing brain. In the CT scan on the left is an image from a healthy 3-year-old with an average head size. The image on the right is from a 3-year-old child suffering from severe sensory-deprivation neglect. This child's brain is significantly smaller than the average and has abnormal development of the cortex (Perry and Pollard, 1997). These images are from studies conducted by a team of researchers from the Child Trauma Academy (www.ChildTrauma.org) led by Bruce D. Perry, M.D., PhD.

Source: The Margaret McCain lectures series, Inaugural lecture by Bruce D. Perry, *Maltreatment and the Developing Child*, 2004

It is not suggested that ECEC professionals engage in diagnosis of any medical condition but they are often best placed to identify possible signs and symptoms and alert parents and other professionals who support the child and suggest that timely intervention may be needed. Whilst it is not possible at present to treat a damaged brain medically and repair it, it is possible through early intervention in terms of additional and specific support to mitigate the problems and achieve better outcomes. It is essential that all those caring for young children understand the importance of the child's previous experience. As soon as a child starts their formal education, record keeping

and a teacher's awareness of their prior learning is, rightly, seen as vital. The importance of learning and experience from pre-birth to 3 has been ignored for too long.

The breastfeeding debate

Breast-fed children are still 30 per cent less likely to have behaviour problems than bottle-fed infants, when compared with other factors such as deprivation and parental age (Heikkila et al., 2011; University of Oxford, 2011). Breast milk contains large amounts of essential long-chain polyunsaturated fatty acids, growth factors which support the development of the brain and the central nervous system. Through a randomised study, causal inference has been made between breastfeeding and intelligence (Kramer, 2008).

Another factor is the importance of the interaction between mother and child when breastfeeding; unless milk is expressed, this role falls solely to the mother so a strong bond can be established. In addition, breastfeeding tends to take longer (in terms of the mother/child interaction) than bottle feeding and the baby will pause, allowing for all-important mother/child 'conversations' (Trevarthen and Aitken, 2001). This closeness and communication, that mirror a conversation, support the mother in talking or singing to the child and help to develop auditory pathways which allow the infant to identify speech patterns and syntax.

REFLECTIVE ACTIVITY

Consider these questions:

- If breastfeeding provides ideal opportunities to assist bonding and support language acquisition, what could you do with babies and young children in your care to emulate this?
- Would it be helpful to find out whether children in your setting have been breast-fed? If so, how could you gather this information sensitively?
- Would it be helpful to compare your results from such an investigation with those of another setting? If so, why?

Conclusion

As seen from the research discussed, there is a range of prenatal factors that a foetus may have to contend with prior to the actual birth. After entering into the world,

the child may still be disadvantaged by the care and experience received. The ECEC practitioner can endeavour to mitigate the impact of negative early experiences on a child's learning and development by offering a range of experiences and opportunities within a secure, stimulating environment and also by offering support to parents. Early intervention can result in long-term gains including better educational and employment outcomes. This intervention needs to be at a point where children are still able to form new neurological pathways and it has been shown that at this early stage, the impact is greater. The longitudinal HighScope study in the USA recognised the cost-effectiveness to society of spending more on supporting children and families earlier, leading to long-term social and financial gains for society (Heckman, 2008). We know now that the first 1000 days of life constitute the most sensitive period for determining lifelong health. We are just beginning to learn more about how these early days affect brain development. It is certainly a sensitive period but it is not yet clear if it is critical in the sense that damage cannot be remedied by later interventions. What is clear is that whether we wish to intervene to prevent physical health problems such as coronary heart disease or delayed development leading to learning difficulties, then the earlier the intervention occurs, the better. Also, a better understanding of how children develop from conception up to the point where they first come into contact with an ECEC professional can and should inform practice and provision.

A response to the case study considering normative development

Discussion

You would possibly suggest that Edward sees either the health visitor or the doctor to ascertain whether a physical problem exists. You might endeavour to meet with both parents to discuss this as there may be language barriers.

Actual outcomes

No physical problem was diagnosed, which came as a relief to both parties involved. The nursery team were still perplexed as to why Edward continued walking in this manner. After conversations with the parents, it became clear that Edward was rarely outside and when he was, he was still in the buggy; even on trips to the supermarket he always went in the trolley. He had not been walking enough to actually move his physical development on since beginning to walk. The team working alongside the parents planned a range of activities to allow Edward to progress his development.

Further reading

Barr, R. and Hayne, H. (2003) 'It's not what you know, it's who you know: older siblings facilitate imitation during infancy', *International Journal of Early Years Education*, 11 (1): 7–21.

Bruce, T. (ed.) (2010) *Early Childhood: A Guide for Students*, 2nd edition. London: Sage. See pp. 91–2.

Bruce, T. and Meggitt, C. (2006) *Child Care and Education*, 4th edition. London: Hodder Arnold. See pp. 222–30, which outline normative development patterns.

Goswami, U. (2008) *Cognitive Development: The Learning Brain*. Hove: Psychology Press. See pp. 61–73 in the chapter 'Infancy: the physical world'.

Keenan, T. and Subhadra, E. (2010) *An Introduction to Child Development*, 2nd edition. London: Sage. See Chapter 1, 'The principles of developmental psychology'.

Useful websites

The UNICEF website has a wealth of valuable information at: http://www.unicef.org.uk

You will find a report on levels and trends in child mortality from 2010 at: http://www.unglobalpulse.org/sites/default/files/reports/UNICEF_Child_mortality_for_web_0831.pdf

You will find information from Children in Scotland, the national agency for voluntary, statutory and professional organisations and individuals working with children and their families in Scotland, at: http://www.childreninscotland.org.uk

You can read the article 'Prolonged breastfeeding may be linked to fewer behaviour problems' at: http://www.sciencedaily.com/releases/2011/05/110510154618.htm

Read 'Investigating how the normal brain develops to improve treatment for patients with brain injury', an article from Cambridge Neuroscience, at: http://www.neuroscience.cam.ac.uk/research/cameos/DevelopingBrain.php

Read 'Pre-birth to 3 – the importance of relationships' by Suzanne Zeedyk, an article for Education Scotland, at: http://www.ltscotland.org.uk/video/p/genericcontent_tcm4639129.asp?strReferringChannel=earlyyearsandstrReferringPageID=tcm:4-633862-64

References

Barr, R. and Hayne, H. (2003) 'It's not what you know, it's who you know: older siblings facilitate imitation during infancy', *International Journal of Early Years Education*, 11(1): 7–21.

Bing-Chen Han, Hang-Fei Xia, Jing Sun, Ying Yang and Jing-Pian-Peng (2010) 'Retinoic acid-metabolising enzyme cytochrome P450 26a1 (cyp25a1) is essential for implantation: functional study of its role in early pregnancy', *Journal of Cellular Physiology*, 223(2): 471–9.

Brown, R.T., Freeman, W.S., Perrin, J.M., Stein, M.T., Amler, R.W., Feldman, H.M. et al. (2001) 'Prevalence and assessment of attention deficit/hyperactivity disorder in primary care settings', *Paediatrics*, 107: e43.

Bruce, T. (2004) *Developing Learning in Early Childhood 0–8*. London: Sage.

Bruce, T. and Meggitt, C. (2006) *Child Care and Education*, 4th edition. London: Hodder Arnold.

Casey, B.J., Galvan, A. and Hare, T.A. (2005) 'Changes in cerebral functional organization during cognitive development', *Current Opinion in Neurobiology*, 15: 239–44.

Children in Scotland (2011) Briefing on foetal alcohol harm. Available at: http://www.childreninscotland.org.uk/ (accessed 17.06.11).

Clavarino, A., Mamun, A., O'Callaghan, M., Aird, R., Bor, W., O'Callaghan, F., et al. (2009) 'Maternal anxiety and attention problems in children at 5 and 14 years', *Journal of Attention Disorders*, 13(6): 658–67.

Dehaene-Lambertz, G. and Baillet, S. (1998) 'A phonological representation in the infant brain', *NeuroReport*, 9: 1885–8.

DiPietro, J.A. (2004) 'The role of prenatal maternal stress in child development', *Current Directions in Psychological Science*, 13: 71–4.

Doherty, J. and Hughes, M. (2009) *Child Development: Theory and Practice 0–11*. London: Pearson Education.

Field, T., Diego, M. and Hernandez-Reif, M. (2009) 'Depressed mothers' infants are less responsive to faces and voices', *Infant Behaviour and Development*, 32: 239–44.

Gerhardt, S. (2004) *Why Love Matters*. London: Routledge.

Goswami, U. (2008) *Cognitive Development: The Learning Brain*. Hove: Psychology Press.

Hanson, J.W., Jones, K.L. and Smith D.W. (1976) 'Foetal alcohol syndrome – Experiences with 41 patients', *JAMA*, 235 (14): 1458–60.

Heckman, J. (2008) *Schools, Skills, Synapses*. Available at: http://www.heckmanequation.org/content/resource/schools-skills-synapses

Heikkila, K., Sacjer, A., Kelly, Y., Renfrew, M.J. and Quigley, M.A. (2011) 'Breast feeding and child behaviour in the Millennium Cohort Study*', Arch Dis Child*., 9 May.

Huotilainen, M. (2010) 'Building blocks of foetal cognition: emotion and language', *Infant and Child Development*, 19: 94–98.

Johnson, M.H., Dziurawiec, S., Ellis, H.D. and Morton, J. (1991) 'Newborns' preferential tracking of face-like stimuli and its subsequent decline', *Cognition*, 40: 1–19.

Kelly, C.A.M., Margulies, B.A. and Castellano, F.X. (2007) 'Recent advances in structural and functional brain imaging studies of attention-deficit/hyperactivity disorder', *Current Psychiatry Reports*, 9(5): 401–7.

Kotulak, R. (1997) *Inside the Brain: Revolutionary Discoveries of How the Mind Works*, 2nd edition. Kansas City, MO: Andrews McMeel Publishing.

Kramer, M.S. (2008) 'Effects of prolonged and exclusive breastfeeding on child behaviour and maternal adjustment: evidence from a large, randomized trial', *Pediatrics*, 121: e435.

Lemoine, P., Harrousseau, H., Borteyru, J.P. et al. (1968) 'Les enfants de parents alcooliques: A nomalies observes: A propos de 127 cas', *Ouest Med*., 25: 477–82.

Meltzoff, A.N. and Moore, M.K. (1983) 'Newborn infants imitate adult facial gesture', *Child Development,* 54: 702–9.

NOFAS (2011) National Organisation on Foetal Alcohol Syndrome – UK at: http://www.nofas-uk.org/index.php (accessed 17.06.11).

O'Donnell, K., O'Connor, T.G. and Glover, V. (2009) 'Prenatal stress and neurodevelopment of the child: focus on the HPA axis and role of the placenta', *Developmental Neuroscience*, 31: 285–92.

Ostera, E.M., Ostera, A.R. and Simpson, P.M. (1997) 'Mortality within the first two years in infants exposed to cocaine, opiate or cannabinoid during gestation', *Paediatrics*, 100: 79–85.

Perris, E.E., Myers, N.A. and Clifton, R.K. (1990) 'Long-term memory for a single infant experience', *Child Development*, 61: 1796–807.

Perry, B. and Pollard, D. (1997) Altered Brain Development Following Global Neglect in Early Childhood, *Society for Neuroscience: Proceedings from Annual Meeting*, New Orleans.

Rakic, P. (1995) 'Corticogenesis in human and nonhuman primates', in M.S. Gazzaniga (ed.), *The Cognitive Neurosciences* (pp. 127–45). Cambridge, MA: MIT.

Rodriguez, A. and Bohlin, G. (2005) 'Are maternal smoking and stress during pregnancy related to ADHD symptoms in children?', *Journal of Child Psychology and Psychiatry*, 46(3): 246–54.

Scottish Government (2008) *The Early Years Framework*. Edinburgh: Scottish Government. Available at: http://www.scotland.gov.uk/Resource/Doc/257007/0076309.pdf

Szalavitz, M. and Perry, B.D. (2011) *Born for Love*. New York: Harper.

Tickell Review (2011) *The Early Years: Foundations for Life, Health and Learning – An Independent Report on the Early Years Foundations Stage to Her Majesty's Government*, 30 March.

Trevarthen, C. and Aitken, J. (2001) 'Infant intersubjectivity: research, theory and clinical applications', *Journal of Child Psychology*, 42(1): 3–48.

University of Oxford (2011) 'Prolonged breastfeeding may be linked to fewer behaviour problems', *ScienceDaily*, 11 May. Available at: http://www.sciencedaily.com/releases/2011/05/110510154618.htm (accessed 21.06.11).

Zeedyk, S.M. (2006) 'From intersubjectivity to subjectivity: the transformative roles of emotional intimacy and imitation', *Infant and Child Development*, 15: 321–44.