Title

How evolution can help us understand childhood development and behaviour

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Biographies

Annie Swanepoel is a Consultant Child and Adolescent Psychiatrist in Hertfordshire. She also holds a PhD in Human Physiology and is particularly interested in the integration of body and mind, nature and nurture, psychoneuroimmunology, as well as evolutionary psychology.

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Summary

We suggest that the traditional disease model, still dominant in psychiatry, is less than ideal for making sense of a range of psychological issues such as the effects of early childhood experiences on development. We argue that a model based on evolutionary thinking can deepen understanding and aid clinical practice by showing how behaviours, bodily responses and psychological beliefs tend to develop for 'adaptive' reasons, even when these ways of being might on first appearance seem pathological. Such evolutionary understanding has implications for treatment, for example by decreasing shame and blame and placing the focus on improving the circumstances of people who suffer. Such an evolutionary understanding also challenges the genetic determinist model, by showing that developmental pathways have actually evolved to be responsive to the physical and social environment in which the individual develops. Thought can now be given to how biological or psychological treatments, as well as changing a child's environment, can foster well-being. Evolutionary thinking has major implications for how we think about psychopathology, and for targeting the optimum sites, levels and timings for interventions.

Learning objectives

- Understand the value of applying the principles of evolutionary theory to human behaviour.
- Understand the evolutionary basis of attachment theory, and how this can help to make sense of different responses to danger, reproductive strategies and internal models of the world.
- Understand how apparently abnormal forms of behaviour can sometimes be seen as adaptive in evolutionary terms.

Declaration of interest

The authors are members of the evo-psychotherapy study group at the Tavistock Clinic. The aim of the group is to promote evolutionary thinking in psychotherapy and psychiatry.

Article

In recent years the 'nature v. nurture' debate has been laid to rest. We now know that genes and environment are inextricably linked. We are beginning to discover how that linking occurs, through the growing discipline of epigenetics (Provencal 2015). Epigenetic research is showing us how, in response to environmental influences, genes are switched on or off. It is also showing us that these effects can be transmitted down generations. Yet surprisingly few people have asked wider questions such as 'why does this sensitivity exist?', and 'why does this sensitivity sometimes lead to apparently negative developmental patterns?' However, these questions can be fruitfully addressed if we turn to an evolutionary perspective.

Organisms that are better fitted to their environment (which means better 'adapted' to their environment) have a greater chance of surviving and producing offspring. There is substantial evidence that environmental sensitivity in infants and children helps them to develop in the ways that will be most adaptive, given the circumstances into which they have been born. In this paper, we explore these dynamics. In particular we focus on how the physical and social environment of parents affects their parenting styles, and how an infant's environment (which consists mainly of the parent) affects development and attachment patterns. We also outline the evolutionary logic underlying these dynamics, arguing that although it is ideal to be loved by one's immediate family and reared in circumstances where there are no material shortages, evolution does not only prepare us for the optimum. We suggest that an evolutionary understanding might be helpful in understanding the development of psychopathology, and might also help us to discriminate between adaptive responses and pathology in psychiatry more generally.

Why we need an evolutionary understanding of human behaviour

Ever since Charles Darwin and Alfred Russell Wallace independently came up with the theory of natural selection, evolutionary ideas have generated controversy, whether as a challenge to religious beliefs, through their dubious use in social Darwinist ideas, or as a result of their misuse in eugenics. In addition, the more reductionist sociobiological accounts of the 1970s (Wilson 1978), which gave scant attention to the role of early experiences, did little to enhance the credibility of evolutionary thought, and gave rise to heated argument about the relative importance of nature versus nurture (Sahlins 1977). In recent years, however, there has been increasing agreement about the extent to which much of human behaviour is the result of natural selection, and we now have explorations of the importance of evolution in areas such as psychotherapy (McGuire 2006), emotional disorders (Nesse 2009) and human sexuality (Launer, 2014). Box 1 lists the principles that need to underlie any evolutionary understanding of human behaviour.

It is now clear that humans are particularly good at adapting to different environments. We survive in a wide range of physical environments, from the Arctic to rain forest to Sahara. We can also survive in a wide range of emotional environments, from loving to neglectful to violent ones. In adapting to specific environments, be they physical or emotional, certain characteristics and genetic potentials will be activated through epigenetic mechanisms, whereas others will be suppressed.

From birth onwards, indeed even prenatally (Music 2013; Glover 2015), humans are continually reading signals about their emotional environment, and their bodies and minds are then adapting to it. Living in a nurturing environment will activate particular genetic pathways and psychological states, whereas living in a violent or unloving environment will activate different pathways and states. Although the pathways activated in hostile environments are typically regarded by psychiatry as pathological, and although they do indeed have profoundly negative effects on longer-term physical and psychological health

(Weder 2014), when looked at through an evolutionary lens we can begin to understand why these pathways exist and how they can be adaptive.

Nesse (2012), one of the leading psychiatrists to incorporate evolutionary thinking into clinical practice, states: “Psychiatry has emulated the rest of medicine by seeking causes and categories in biological mechanisms, but because it lacks the kind of functional framework that physiology often provides for the rest of medicine, there is a temptation to conceptualise disorders in an essentialist way that oversimplifies reality” and concludes that “mental disorders will be fully understood only when we can, as in the rest of medicine, understand pathology in terms of normal functions as well as normal mechanisms”.

We aim to illustrate this principle using attachment theory.

Attachment theory

Attachment theory was formulated by the child psychiatrist John Bowlby (1969). At its core was the observation that infants are born with a need to form a strong bond to their main caregiver (usually the mother). If they are to become psychologically healthy, their caregiver has to respond to this need by providing dependable, sensitive and loving nurturance. Bowlby showed that when such care is available, children grow up to become what we regard as psychologically healthy. He called such children ‘securely attached’. In contrast, Bowlby felt that when such care is not available, children were being pushed towards psychopathology. He called children who grew up without sensitive care ‘insecurely attached’.

Bowlby was influenced both by the study of other animals and by evolutionary theory. In formulating attachment theory, he was adamant that we need to take account of the environment in which *Homo sapiens* evolved. He called that environment the ‘Environment of Evolutionary Adaptedness’ (EEA), and primarily envisioned it as the two million years when humanity’s ancestors lived as hunter-gatherers. Bowlby argued that in the EEA, attachment evolved to keep infants close to mothers who would not only feed them, but also protect them from predators.

Bowlby’s work was further developed by his colleague Ainsworth (1978) who identified two different kinds of insecure attachment in children: ‘insecure-avoidant’ and ‘insecure-ambivalent.’ Main & Solomon (1986) described a further category which they termed ‘disorganised’ and found to be prevalent in children who suffered abuse or neglect. This classification of attachment patterns has been validated around the world in many studies, although interesting cultural variations exist (Cassidy & Shaver 2010). Box 2 summarises the different attachment styles in children.

Is secure attachment really ‘normal’ and insecure attachment ‘abnormal’?

Bowlby and Ainsworth believed that secure attachment was ‘normal’ and evolutionarily adaptive, whereas insecure attachment was an abnormal and maladaptive. However, in the early 1990s, evolutionarily-minded researchers, in particular James Chisholm (1999) and Jay Belsky (1997) began to ask: *Is the trajectory embodied in insecure attachment really an abnormal and maladaptive artefact of ‘inadequate’ parenting, or has it been shaped by natural selection because it has evolutionary value?*

One reason for asking this question was that it had become well established in the field of animal behaviour that a developmental trajectory that was adaptive in one environment would not necessarily be adaptive in a different environment. Moreover, studies had shown

that development was plastic enough for individuals to follow the pathways that would most likely be adaptive, given the environment into which they had been born. Zoologists called the different forms of morphology, physiology and behaviour that result from such plasticity, 'conditional adaptations.'

An environmental feature discovered to be commonly associated with conditional adaptations is the relative benevolence or harshness of that environment. In a diverse array of species, the developmental trajectories that give individuals the best chance of surviving and reproducing in harsh, unpredictable or dangerous environments are different from the ones that are successful in mild, stable and benign environments.

This discovery is relevant to humans because we now know that the environment in which we evolved was not always benevolent. In fact, during the long period when our ancestors lived as hunter-gatherers the climate was particularly unstable (Potts 2010). As a result, life was often very precarious indeed. It was not only the physical environment that brought uncertainty and danger to ancestral infants and children. The family environment was just as crucial (Chisholm 1999; Hrdy 1999). Some children were born to mothers who were healthy and adept at gathering food, and who had a network of relations who could help with child care and provisioning. Others were born to mothers who struggled with their health, were less adept at gathering food, or had little social support (Chisholm 1999; Hrdy 1999, 2009). In fact, life could be particularly precarious for human children (compared to other great apes) because they remain dependent on parents long after weaning. During times of dire shortage, ancestral mothers would have needed to favour one child over another if she was to have at least some surviving children (Hrdy 1999, 2015). A child living in the EEA, who was less favoured than his or her siblings, would have been in a life-threatening situation (Sieff 2015).

We now turn to some of the key features of attachment patterns – the fear system, reproductive trajectories, and internal models– and examine how the characteristics of insecure attachment might actually be adaptive in certain circumstances.

Fear system

Early attachment stress contributes to shaping an individual's fear reactivity, through calibrating the hypothalamic-pituitary-adrenal (HPA) axis (Rincón-Cortés 2014). Attachment security during early life is associated with creating a resilient fear system, which responds less reactively to threats and returns quickly to a calm state when the threat has passed. In contrast, early emotional insecurity is generally associated with having a sensitised HPA axis which leaves the individual forever on the lookout for danger, and means that even after a perceived threat has passed, it takes a long time for it fear levels to return to base levels (Oosterman 2010).

This pattern is not unique to humans. In harsh conditions individuals of many species develop a fear system that is particularly sensitised to danger (LeDoux 2014) . For example, rat mothers who are stressed spend less time licking and grooming their pups than unstressed mothers. In response to this relative lack of maternal nurturance, epigenetic mechanisms are activated that calibrate the pups' hypothalamic-pituitary-adrenal (HPA) axis in ways that build a reactive fear system (Diorio 2007; Francis 1997). Behaviourally, the HPA-sensitised pups grow into adults who are reticent about exploring new ground, reluctant to go out into open spaces, and more fearful generally.

Although the costs associated with this fearful behaviour are significant, wild rats become stressed when living in an environment which contains large numbers of predators, and under such conditions a sensitised fear system enhances the chance of surviving.

Evolutionary thinking suggests this heightened sensitivity to fear is adaptive. The same adaptive logic is relevant to our own species (Evans 2013, Flinn 2011).

Among humans, a highly reactive HPA axis has costs in terms of physical health and mental well-being (Lanius 2010). It increases the risk of suffering from cardiovascular and other diseases, anxiety disorders and causes the loss of neurones in the hippocampus, which is crucial to memory. Additionally, people with a reactive fear system spend more energy anxiously scanning their world for possible threats. They are at risk of seeing danger where none exists, and then behaving in ways that create self-fulfilling prophecies. They also have less time and energy to invest in more fulfilling and creative pursuits (Sieff 2015). However, for individuals born into dangerous environments, these disadvantages are insignificant compared to dying young and childless, which is an evolutionary dead-end (Chisholm 1999).

Reproductive Trajectories

The area of evolutionary biology that considers the timing and pattern of reproduction is called 'life history theory' (Kaplan & Gangestad 2005). Two of the central questions addressed by life history theory are:

1. Are individuals, in a given set of circumstances, likely to have more surviving offspring if they wait to accrue resources (including body mass, knowledge and social connections) before starting to reproduce? Alternatively, are they likely to have more surviving offspring if they limit their own growth and start reproducing as young as possible?

2. Do individuals, in a given set of circumstances, have a greater chance of producing surviving offspring if they have a few children in whom they invest a great deal of time and care? Or will their chances be greater if they have many offspring, and give only the bare minimum of care to each child?

Throughout the natural world, these two facets of reproduction commonly converge, and express themselves in differing reproductive strategies that are commonly termed 'fast' and 'slow'. A 'fast' trajectory means starting to reproduce early and having many children. A 'slow' one means doing the opposite. It is important to emphasise that the trajectories are not followed as a result of conscious choice; rather they are epigenetically embodied unconscious strategies that have evolved over the millennia. The main features of these two trajectories are listed in Box 3.

Mathematical modelling also confirms that, in benevolent environments, an individual is likely to produce more surviving descendants by following the slow life history (quality) pathway. Conversely, in harsh and dangerous environments, following the fast life history (quantity) pathway offers an individual a greater chance of producing descendants. This is because in a dangerous world, the longer an individual waits before having offspring, the greater the chance of dying without leaving any descendants. Also, in unpredictable environments, parents have a greater chance of leaving descendants if they have as many offspring as possible, because they have more tickets in what is essentially a lottery (Chisholm & Sieff 2015).

It has been argued that secure attachment is congruent with the slow, 'quality' orientated life history pathway, whereas insecure attachment is congruent with the fast, 'quantity' orientated life history pathway (Belsky 1997; Olderbak 2006). Adults with a secure attachment status are choosier about their partners, wait until they are older and have accrued resources before starting to have children, have fewer children, and maintain stable

relationships. Those who are insecurely attached are more likely to be at the opposite ends of the scale on those continua (Belsky 1997).

Although not addressing attachment status directly, several studies have shown that in neighbourhoods with low life expectancy (i.e. a relatively harsh environment), a significantly higher percentage of women have their first child when teenagers, compared to neighbourhoods when life-expectancy is longer (Wilson 1997; Nettle 2011). Research has also shown that those who suffer childhood stress go through menarche at a younger age, become sexually active at a younger age and are likely to have children when younger than peers who did not suffer comparable stress (Ellis 2007; Nettle 2010; Tither 2008). Michael Meaney's group have begun to identify the epigenetic mechanisms that are likely to mediate this plasticity, for example the epigenetic modification of the promotor of the oestrogen receptor (ERα) with downstream effects on gene expression (Cameron 2008).

There are severe costs to following the 'fast' pathway, many of which have been quantified for humans (Chisholm & Sieff 2015). These costs are known to all Western governments who try to minimise teenage pregnancy. But suffering these costs would have made adaptive sense for those of our ancestors who were living in a dangerous world, where adult life was precarious and child mortality was 40 per cent or more.

Internal models

As a result of attachment relationships, humans acquire 'internal models' of the relational world. Sarah Hrdy (1999, 2009) argues that the different forms that these models can take are best understood as part of a conditional adaptation to the social environment into which an individual has been born. She calls humans 'cooperative breeders', meaning that ancestral mothers depended on help in raising offspring. This help was necessary because of the long period of post-weaning dependency, which in turn meant that human mothers (unlike other primates) had to provision several children simultaneously. Thus, Hrdy argues, a mother's social network was a hugely important environmental factor; although ancestral children born to mothers with limited social support could have survived, their chances of surviving would have been better if they used different ways of relating compared to children who benefited from being born into a large social network. See Box 4.

In sum: in a benign environment where parents are well and have adequate support, they will be likely be capable of providing sensitive and responsive care to their children, who will as a result adapt to become trusting, open and loving (ie securely attached). However, if parents are stressed, whether due to ill health, poverty or having less social support, they may be less able to provide consistent care to their offspring. Such children will then adapt to the harsh environment by becoming either compulsively self-reliant (avoidant attachment), or by becoming clingy and compulsively care-seeking (ambivalent attachment). In these cases, children will also develop highly activated stress systems – mirroring their parents' stress, and hence adapting to the more stressful circumstances they are exposed to. We know that chronic high stress levels contribute to mental and physical disorders in later life (Danese 2009) – however, this does not inhibit reproduction and thus the cycle is perpetuated unless the environment changes.

It is more difficult to see the adaptive value of disorganised attachment – as this is the predominant pattern in children who have been abused, neglected, or raised by caregivers who were traumatised themselves. Hrdy (2000, 2009) has argued that in previous times, children would not have survived such adversity. As such, she suggests, the pathology seen is not adaptive, since it would not have resulted in the ability to reproduce and raise offspring who survived. However, other thinkers have argued that at least some psychiatric disorders

may well be adaptive, although this has by no means been proven. See Box 5 for examples that have been hypothesised.

How does an evolutionary perspective view the role of maternal care in child development?

According to Barker's hypothesis (Hales & Barker 1992), the metabolism of an unborn foetus is programmed by the mother's diet. Hence, mothers who were pregnant during a famine will tend to have babies who have a 'thrifty phenotype'. These babies would be adapted to survive with less food than average. If food were to become abundant, they would tend towards metabolic complications. Through signals picked up during intrauterine life, foetal programming prepares the infant to adapt to the environment it is likely to be be born into (Glover 2011, 2015). The same principles function after birth. Such a perspective views maternal behaviour as a crucial (albeit unwitting) part of conditional adaptation, arguing that the bodies and minds of infants have evolved to 'use' the quality of their early experiences as information. This information indicates to the developing brain and body something about the benevolence or harshness of social and physical world that each infant has been born into, and might therefore expect to encounter in future (Belsky 1997; Chisholm 1999, 2015, Simpson 2008).

However, we have to be absolutely clear that this is not about blaming mothers. Such a view of foetal programming simply argues that in environments that are tough, either socially or physically, mothers are preoccupied and as a result are not able to nurture their infants as responsively and patiently as they would if they were less stressed. This view also suggests that over many millennia (perhaps going all the way back to the origin of mammals) infants evolved embodied systems that responded in ways that would enhance their survival, given that they had been born into a challenging world.

Some individuals are more sensitive to their early environments than others

Another twist to the evolutionary story is that, although all infants show a degree of adaptability, some infants and children are more 'plastic' than others (Bakermans-Kranenburg 2011; Belsky 2014). Previously it was thought that adverse experiences predisposed some children and adults to stressful responses more than others – that some children were simply born more 'vulnerable'. In fact, we have learned that some children are not just more vulnerable but are more 'plastic', and so are more influenced by their environments generally. These individuals might show higher than average stress responses when receiving insensitive parenting, but lower than average responses with good parenting (Beaver 2012). Such children have been likened to 'orchids' – compared to 'dandelion' children who are robust, resilient and survive even in harsh environments (Kennedy 2013).

Parents will raise their children to survive in the current environment, but there is no guarantee that the world might not change dramatically. If the world is benign, then the 'sensitive orchid' children may do better, but if it changes dramatically and becomes hostile, fitness is enhanced for the 'resilient dandelion' type.

New research also suggests that this has implications for treatment. Some children will be more influenced than others by certain treatments (Kennedy 2013), such as some parenting interventions and drug treatments. Research strongly suggests that this variation is due to underlying genetic differences and that individuals with more plastic genetic variants are much more affected by some treatments than those with alternative alleles (Bakermans-Kranenburg 2015). Candidate genes in this process are the serotonin receptor gene 5HT (Lesch 2011) and the dopamine receptor gene (Bakermans-Kranenburg 2011).

Conclusions

An evolutionary perspective does not see one single developmental pathway or attachment pattern as normal, and the others as abnormal – or one as functional and the others as dysfunctional. In a safe world, the pathway described as secure attachment, and associated with a 'slow' life history, is more adaptive. In a dangerous world, the pathway described by insecure attachment, predisposing to a 'fast' life history, is more adaptive in terms of survival and reproduction, even if it does create genuine suffering.

Understanding this can help to reduce shame, and also increase empathy among others for behaviours and life-strategies that are otherwise difficult to understand and cause suffering. Instead of labelling people who were raised in harsh circumstances as 'pathological' or 'dysfunctional', we can see that it is a sane response to a stressful world. However, this has significant costs. A 32-year prospective cohort study (Danese 2009) showed that children exposed to adverse psychosocial experiences have enduring emotional, immune and metabolic dysregulation. This helps to explain their elevated risk for age-related disease and indicates that the promotion of positive psychosocial experiences for children is a necessary and potentially cost-effective target for the prevention of age-related disease.

Understanding the importance of the environment also creates the potential to improve clinical outcomes: for example, by increasing the resources given for parenting programmes and adequate social care. In addition to targeting community and environmental interventions, future research into epigenetics and differential susceptibility may inform our thinking about which treatments might work best for which patients (Bakermans-Kranenburg 2015).

In conclusion, understanding the evolutionary adaptations that underlie symptoms and behaviours can help us to make sense of them in a new way and to take a more sophisticated approach to psychopathology, enhancing the possibility of intervening both appropriately and with greater compassion.

BOX 1: How evolutionary principles apply to human behaviour

- Each human alive today is the result of a continuous, unbroken line of ancestors stretching back some three and a half billion years.
- Genetic traits cannot survive across generations if the carriers of these genes do not mate and reproduce.
- In evolutionary terms, it is better to survive and have the chance of reproducing, even if at considerable individual cost.
- Traits that do not interfere with reproduction are not selected against – i.e. any disease that originates in later life, i.e. after the reproductive age, is not eliminated through natural selection.
- The traits and behavioural options that have survived are likely to have done so for good reasons. This may include many of the traits that are often termed pathological, such as depressive or violent temperaments.

BOX 2: Secure and insecure attachment (percentages reflective of UK and US population)

- Children with *secure* attachments (appx 50%) have caregivers who are generally sensitive and attuned to their needs. Such children see themselves as worthy of

being loved. They generally develop good social skills and high levels of empathy. They form unconscious internal models which see their parents (and other people) as trustworthy.

- Children with *insecure avoidant* attachments (appx 25%) tend to have neglectful, distant and unresponsive caregivers. Such children learn to block the need for human connection and grow up determinedly self-sufficient. Typically, such children struggle to feel empathetic.
- Children with *insecure ambivalent* attachments (appx 15%) tend to have inconsistent caregivers who swing between being intrusive and being dismissive. These children generally become hyper-tuned to their attachment figures. They can be extremely sensitive to any hint of withdrawal or intrusion. They consequently tend to struggle to relate empathically.
- Children with *disorganised* attachment (appx 10%) typically experience abuse and/or neglect or caregiving by a parent with mental illness. Such children experience "fear without solution", as their caregiver, to whom they are primed to turn when they are scared, is also the source of their fear. They often spend long periods of time being emotionally dysregulated and have a high chance of psychiatric and physical disorders later in life (Danese 2009).

BOX 3: 'Fast' and 'slow' life histories

- 'Fast life history' individuals begin reproducing at a young age, and tend to have more offspring, each of whom gets less nurturance. They can be described as following a biologically embodied unconscious strategy that prioritises 'quantity' over 'quality.'
- 'Slow life history' individuals defer reproduction, and tend to have fewer offspring, in whom they invest considerable resources. They can be described as following a biologically-embodied, unconscious strategy that prioritises the 'quality' of offspring over their 'quantity'.

BOX 4: The effect of social support on internal models

- A child who is born to a mother with considerable social support will generally grow up believing other people are trustworthy. Such a child will feel it is fine to ask for help, and that s/he is worthy of being helped.
- A child born to a mother with a limited social network is more likely to have an unconscious internal model of being unwilling to go to others for help. This is adaptive in situations where help is not available. However, it can hinder children from seeking and accepting support that becomes available later in life, e.g. therapy. This has been termed 'double deprivation' (Williams 1974).

BOX 5: Hypothetical adaptive values of some psychiatric disorders

- Depression may help people give up on goals that they are unable to reach (Nesse).
- Post-traumatic stress disorder (PTSD) may offer survival value in avoiding situations in which they were previously traumatised (Baldwin 2013).
- Incomplete penetrance of schizophrenia genes may lead to improved creativity in relatives of schizophrenia sufferers (Pearlson 2008).
- Attention-deficit hyperactivity disorder (ADHD) may improve the ability to survive in a hostile world by increasing attention to danger and willingness to explore (Glover 2011).

- Conduct disorder may have advantages in the enhanced willingness to fight (intruders or predators) (Glover 2011).

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MCQs

Select the single best option for each question stem.

1. In evolutionary thinking, 'survival of the fittest' is generally understood to mean:

a. the strongest individuals in any generation are the most likely to survive
b. individuals that are physically fit are usually the most fertile
c. individuals that fit the environment best are the most likely to have descendants
d. if you have undesirable traits like being violent, you are less likely to reproduce
e. if you fit the environment well, you are guaranteed to have descendants

2. According to attachment theory, it is true to say:

a. securely attached children will always remain close to their carers
b. children who are insecurely attached will not make much eye contact with their carers
c. children with avoidant attachment patterns prefer their parents to be more withdrawn
d. chaotic or inconsistent parenting will make children pathologically anxious
e. a child with an unresponsive parent is more likely to grow up with difficulty feeling empathy

3. The hypothalamic-pituitary-adrenal axis (HPA):

a. is sensitised by early childhood experiences
b. is less activated in adverse environments
c. is the part of the nervous system responsible for awareness of danger
d. may be programmed as 'vulnerable' by a difficult birth
e. is more likely to be plastic in insecurely attached children

4. In life history theory:

a. 'Fast' life history people divide their resources unequally between their children
b. Individuals with 'slow' life histories often prefer not to marry or reproduce
c. Parents living in difficult circumstances are less likely to invest much in each child
d. Parents who have children late in life are unlikely to be hostile or detached towards them
e. People who live in more dangerous environments are likely to have more children

5. Internal models of the world:

a. are always maladaptive in aggressive people
b. shape how much we are inclined to ask for help from others
c. are programmed mainly by the serotonin receptor gene
d. are the principal cause of social deprivation
e. are mostly determined by the size of our families

Correct answers: 1c 2e 3a 4e 5b