Genes

Your baby has a unique genetic make-up. She has incredible potential yet the experiences she has are extremely important: each experience has an effect on which genes are spurred into action.

New evidence from the science of Epigenetics shows that many experiences – including exposure to good or bad nutrition, as well as stress emotional experiences in our family of origin, with our mums, dads and siblings – impact gene expression. The once popular belief that the genes we inherit are fixed for life has now been turned on its head - and we know now that our environment, and our feelings, can change our genes. And the impact of these influences in pregnancy, when the brain, nervous system and body are forming, can be huge. For more click the link to the Time Magazine article at the bottom of the page; or read our recent blog.

If you're interested in the science behind our behaviour, and how relationships impact us at a cellular - or genetic level - read on!

DNA

Our DNA genetic code is in the nucleus of every cell in our body. Instructions in the form of chemical molecules trigger the RNA stored in the cytoplasm of every cell. The RNA in turn sends signals to switch on proteins in the cell and these are different for each type of body cell. The proteins are the way the individual cell functions and communicates with other cells, and their presence or absence depends on experience - what we come into contact with in the environment, and the feelings we have in relation to other people.

Nature and nurture

Until recently it was widely believed that nature – i.e. inheritance – was the driving force behind gene expression. But it is now clear that the way our genes express is heavily influenced by our experience. And this is hugely important when we think about our children's experience and how this influences their development.

Experiences that trigger gene expression range from our environment (including the air we breathe, the food we eat, and how we are loved and held etc.) to the molecules in our body (hormones, pepetides, neuro-chemicals and more). For example the environment will include touch and eye contact, both of which are linked to specific sequences of gene expression. What's most important, is what your baby feels emotionally: the turning on and off of cascades of gene expression begins within seconds of receiving psychological signals and may continue for hours, days, weeks – or even a lifetime.

Love and stress

When your baby feels loving kindness and caring, certain genes are expressed that actually assist the production of new brain cells and wiring between groups of cells that allows a positive outlook. Love in infancy inclines us to feel love, and to be loving, in adulthood.

Other specific genes are triggered in times of stress and anxiety. The experience of stress can turn off the interleukin-2 gene. This begins a cascade of events and has numerous results including reduced functioning of the immune system, which leaves a person more vulnerable to infections. Positive psychosocial experience, on the other hand, can turn on the interleukin-2 gene within an hour or two, to facilitate molecular communication, healing and health. Emotionally supportive experiences within a loving group (the family) optimise immune function.

Excessive psychological stress may lead to numerous changes in gene expression that effect many body systems. In a state of stress several hormones including cortisol are released. These can reset genes that govern body rhythms and also disrupt the behaviour many body organs, including the heart, liver or kidney, and to disturb blood pressure, sleep-wake cycles or digestive rhythms. You see this in action when your baby feels 'separation distress'.

Genes and the nervous system

The genes associated with feelings of being loved, or being stressed, are a special class of genes known as Immediate Early Genes. What's really interesting in terms of a developing baby is that when activated, these genes initiate molecular events that alter the physical structure of the baby's developing nervous system. This is proof that our environment has a major effect on our emotional and physical being.

Touch

Touch is so important for a baby that it can make the difference between sickness and health, or even life and death: you'll find more about this on our touch page.

A mother's touch (or the touch of another loving adult) can activate Immediate Early Genes that in turn activate a target gene called ODC. Turning on the ODC gene leads to the production of growth hormone essential for the baby's growth. Babies who are deprived of touch often fail to thrive. But administering growth hormone alone, without touch, does not improve growth. 28 other genes are expressed along with the ODC gene. Among these is brain-derived neurotophic factor gene for normal brain growth.

Mum's influence

The power of touch on genetic expression is an example of how nurturing affects us, and it is not just a case of growth. The quality of the mother-baby relationship can affect whether genetic disposition is activated or not.

> "While genes are pivotal in establishing some aspects of emotionality, experience plays a central role in turning genes on and off. DNA is not the heart's destiny; the genetic lottery may determine the cards in your deck, but experience deals the hand you can play. Scientists have proven, for example, that good mothering can override a disadvantageous temperament. They arranged for especially nurturing monkey mothers to adopt baby monkeys genetically prone to anxiety. Anxious young monkeys usually become inhibited, low-ranking adults. The substitution of an attentive mother reversed their fates - once on a genetic path to a lifetime of timidity, these well-loved monkeys became dominant in their troops. The inverse also holds: inadequate nurturance can disrupt a healthy limbic inheritance, imposing anxiety and depression on someone who had the genetic makings of a happy life."
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> From A General Theory of Love; Thomas Lewis, Fari Amini; Richard Lannon.

State dependent memory

We each have a natural (inherited) and an acquired (learnt) pattern of behavioural state-related gene expression that contributes to the way we feel and think, and to our health. Our brains and bodies are exposed to numerous molecules that differ depending on the experience we have. In stress, for instance, adrenalin and cortisol are the chemicals that may rise; in happiness levels of endorphins will be higher; with loving touch, our cells produce higher levels of oxytocin and prolactin.

In our early years, in the womb and beyond, our genes are activated or suppressed depending on the situations that arise … emotional feelings, sounds, touch sensations, tastes or exposure to naturally occurring or manufactured chemicals. When experiences are repeated, or when they are particularly intense, a pattern of gene expression becomes established. This is known as state dependent memory, learning and behaviour.

Many aspects of science point to the significance of what babies learn in their early years, and now the science of gene behaviour is adding to the evidence. What your baby experiences in early life conditions her genes (and in turn her brain and body) to behave in a certain way.

With loving support and conscious parenting there is a wonderful opportunity to give your child a great gift: you cannot determine how she will respond to stress, but you can minimise stressful situations (such as separation or prolonged crying) and, when she does become agitated, be there with love, holding and safety. You do have the power to prime your baby's unconscious reactions to life's stresses – right down to influencing the behaviour of her genes.

Natural body substances include stress hormones, love hormones, neuropeptides and growth factors. All these activate or suppress gene expression and can modulate state-dependent emotions and behaviour. Under stress, for instance, certain patterns of memory, learning and behaviour are learned or encoded. These will then be repeated in the future - unless an experience arises that causes change.

Never too late: change in adulthood

Many of the seeds for state dependent memory are laid early in life, even in the womb. Although this early planting may yield results throughout life, with characteristic behaviours and reactions, what your baby experiences now – or what you experienced as a baby – does not set in stone how you will feel and experience life as an adult. It does influence it (and the Hebbian theory of neural wiring says the same) but it is never too late for change to occur, even at the level of learned genetic behaviour.

There are ways in which you can modulate genetic expression, to encode new memory and learning. Consciously, you can redesign your own template of state-dependent memory and learning. Vivid conscious experience can turn on genes that code for proteins that lead to neurogenesis (the growth of new brain cells). This is the anatomical and molecular basis of our ever changing memory, and for continual learning and new behaviour, and the genes involved are known as activity-dependent genes. Gene behaviour can also be critically modified through experience.

An experience can induce the expression of activity-dependent genes within a few minutes. It may come from work, play, social activities and even from dreams, visualisation or meditation, or from exercise or controlled movements such as yoga. A similar effect of changes in established patterns of neural networking in the brain - because the brain can always change (this is known as plasticity). Choosing to consider your infancy, and to listen to and learn from your child may be one such new experience, and from what participants on our courses tell us, even without knowing anything about genes. the effects can be truly transformative.