The possible onward transmission of the effects of institutionalisation of children
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In recent years two major studies have investigated catch-up by children adopted or fostered from residential institutions. The Bucharest Early Intervention Project led by Prof Charles Zeanah of Tulane University School of Medicine compared the development of children fostered from orphanages in Romania with controls[1]. The research led by Prof Michael Rutter of the Institute of Psychiatry, London, compared the development of children adopted from Romanian orphanages by families in the UK with that of British born adopted children[2]. Both found good catch-up by children adopted early.

For those who remain in institutions throughout their childhoods the obstacles to catching up and integrating into the mainstream of society are formidable. If they fail to catch up and integrate, what of their children and grandchildren? We would expect at least a gradual return to the mainstream. We have come to think of a person's genes as a safe repository of the biological information needed to reproduce reliably, a buffer which will withstand most adversity except radiation.

So they are, but our genes are not the sole determinants of hereditary transmission. The model in which the genes control development totally had fitted well with the dominant thinking of the first half of the 20th century, when the concept of central command and organisation was developing[3]. With steady progress in the study of genetics, for a time it looked as though our genetic make-up could be mapped precisely, and the functions of each gene identified, like Mendeleev's Periodic Table. We would see our lives mapped in our genes. But the human genome project, which mapped all three billion components of one man's chromosomes (2001), fell far short of that. It did, however, lead to some important questions. Though it mapped the genes, genetics has so far failed to ascertain the function of 98% of them. For too long we have taken Gregor Mendel's model of transmission by dominant and recessive genes as the prevailing mechanism of genetic transmission, when in fact it belongs within the 2% we know about. Huge questions remain unanswered. The genetic composition of all the approximately 200 types of somatic cells in our bodies is identical. What makes those cells different?

Epigenetic change
Research in recent years has shown that when environmental circumstances change markedly, heritable change can come about despite the genes remaining unchanged. Gene activity, "expression", can be turned on or off like an electric light. Epigenetics is the study of gene expression, "epi" meaning "on", or "beyond", the genes. Transgenerational epigenetic change can be much more rapid than the very slow process of change through natural selection and the occasional mutation. In rats poor mothering is transmitted epigenetically to the offspring. There is some evidence that this is also the case in humans[4].

To what extent each gene is expressed depends much more on the environment, acting through epigenetic mechanisms, than was thought even a few years ago. Unlike genetic changes, such epigenetic changes can be reversed, but as a trans-generational process. We might call the genes the hard wiring and the epigenetic mechanisms the soft wiring. The interaction between them is such that if the environment is changed markedly, it will affect expression of the genes.

It is only this century that epigenetics has shown that changes can be transmitted from generation to generation through non-genetic mechanisms and how fast those changes can take place. Long-term research has shown that not only the children who were *in utero* during the Dutch "winter of hunger" (1944-45), but also *their* children, were affected by their mothers' starvation. It was through "regulation" of gene expression that the effects were transmitted to the grandchildren.

In Romanian baby houses children were not only socially deprived but also malnourished[5]. The cause was not simply that the diet was inadequate, but the way they were fed contributed to their not swallowing even much of the food they were fed. It is common in baby houses in Russia too for children to be fed in a hurry and from behind, with minimal human contact.

Children feed poorly in those circumstances, and when the child pauses, the food may be removed. The two main human studies of epigenetically inherited changes have followed starvation. The effect was originally on the foetus, but can we be sure that malnutrition of children in baby houses will not be transmitted as ill health to their descendants?

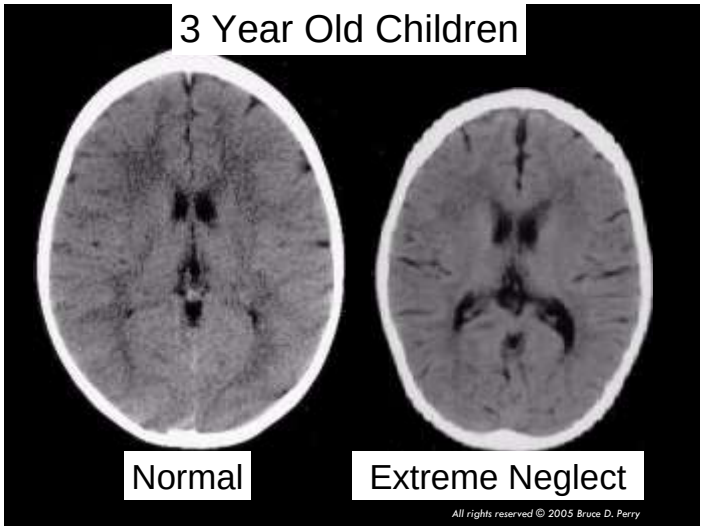
Epigenetically inherited changes may be adaptations essential for survival, but adaptation to a very poor environment militates against an individual or line later adapting to an improved environment. This mirrors the pattern of attachment of baby and toddler to mother or both parents. A child may develop, for example, an 'avoidant' attachment as a necessary adaptation to a certain type of parenting, but that is likely to remain that individual's dominant attachment type for life, even when there are opportunities for more secure attachment.

Cultural inheritance

Epigenetics is not the only explanation for Homo sapiens being on a much faster track than we thought. Over the last 10,000 years there has been enormous change in human cognition and skills, while the other great apes continue to evolve much more slowly. That time span has not been long enough for natural selection to have had a substantial effect[6]. What else can account for the acceleration of change in humans?

Human evolution is now mediated much more by cultural than genetic factors. Isaac Newton said that a dwarf sitting on the shoulders of a giant can see farther than the giant. That is cultural evolution. Each step we take forward can become a new platform from which to take the next step. Cultural evolution gathers pace exponentially. But paths which lead to destruction or dead ends are just as likely in cultural as in Darwinian evolution. And if the giant is society, what happens when a child is not on its shoulders but at its feet?

There is a neurological counterpart to these changes. Animals with larger brains show a faster evolutionary pace that smaller-brained animals. Large brains are associated with more social learning. The bigger the brain, the more you learn, and the more you learn, the bigger your brain[6]. The smaller the brain, the less you learn. Children raised in institutions have been shown to have smaller brains than family children[7].



The above PET scan images, from studies by Bruce D. Perry, M.D., Ph.D. at The Child Trauma Academy (www.ChildTrauma.org), illustrate the impact of neglect on the developing brain. The CT scan on the left is from a healthy three year old child with an average head size (50th percentile). The image on the right is from a three year old child following total global neglect during early childhood. The brain is significantly smaller than average and has abnormal development of cortical, limbic and midbrain structures.

Implications for child development

Now we know that, as Jean-Baptiste Lamarck postulated in 1809, acquired characteristics can, in certain circumstances, be inherited. This is no longer the heresy that it had long been in the West. And changes can be transmitted to later generations faster than ever before and much faster than, until recently, was realised. Change which is inherited by children from the

culture of the wider parental generation is now accelerating, and we see the impact of the quickening pace change first in children as, for example, in shortening of attention span.

This acceleration is an obstacle for those who have grown up in institutions. While mainstream populations may be evolving fast to adapt to ever more complex societies, for those populations left behind, adapted to poor environments, catch-up becomes more and more difficult and unlikely.

Both where genetics and child development are concerned, East and West have largely evolved in different directions. Lenin wanted to speed up the process of societal change. He believed "Man can be made what we want him to be"[4]. The Soviet Union was planning to industrialise fast and Lenin wanted the new Soviet man and woman quickly. He is said to have asked Pavlov in 1919 if it was possible to engineer human nature[8].

Whatever Lenin had in mind, a generation later political ideology and pressure for fast results interfered with science in ways which were to set the Soviet Union back in this field by 40 years. In 1948 *Pravda* and *Izvestia* published a lengthy report by Academician Trofim Lysenko. The main content was "The chromosomal theory of inheritance and the existence of genes were rejected"[9]. Lysenko, only fell from grace in 1964, and even then he remained head of a large research institute until his death in 1976. When the gulag prison camp system was dismantled in 1965, not one of the former prominent geneticists was found alive. Stalin had applied eugenics to the geneticists.

Diagnosis and provision for children with disabilities and children at risk are prime indicators of a society's concern for its members who are in most need. In most western countries there has been steady movement towards integration of children with disabilities into society and their inclusion in mainstream education whenever possible. Though the USSR consigned genetics, "nature", to the dustbin of history, it did not give primacy to environmental factors, "nurture". Strangely it initiated practices which appear to stem from a neo-Darwinian ethos of the "survival of the fittest", surely the opposite of its political philosophy. In many former Soviet countries systems are still in place which segregate children with disabilities and which will ensure that many remain in a lower stratum of society throughout their lives. Practices based on rampant "survival of the fittest" continue in most former Soviet countries, with scant safety net for children most at risk.

In Russia and at least most former Soviet countries children in residential baby homes are transferred at the age of four either to children's homes with education or to internats with no, or minimal, education. The decision is made by a Psychological Medical Pedagogical Commission on the basis of usually brief testing which purports to measure a child's capacity to learn. The procedure overlooks the effect that up to three years of institutionalisation has had on the child's level of function and therefore appears to be based on a belief that hereditary endowment overwhelmingly controls development. These practises assign many children to institutions with human environments which set a very low ceiling on their potential for development and allow little probability of catch-up. This practice appears also to ignore recent advances in study of plasticity within neuroscience.

Any measure of intelligence is culture specific. But the culture in which a child grows up in a baby house is very different from a family culture. So if the measured intelligence of these children is to be used as any indicator of their potential for development, clearly scales need to be designed and validated specifically for children in institutions.

The larger brain size of humans compared with other great apes correlates with increased social interaction and the development of empathy. Homo sapiens' capacity for empathy has been very important in our evolutionary progress. But if this capacity is not expressed, "compassion and the quest for emotional connection will fade away as surely as sight in cave dwelling fish"[10].

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