

Nurture of the Brain, Nutritional and Emotional, in the Context of Evolution, Ecology, and the Lifecycle

Simon H. House

Abstract: The dialogue between biosphere and brain is powerfully affecting human development. First the biosphere evolved the brain, and to such power that it is now dangerously changing the biosphere. These changes are in turn harming the human brain, disorders of which already cost Europe alone the huge annual sum of 500 billion Euros (Eur Fed Neur Socs 2005/2008). The greatest source of essential nutrients for the brain is the sea, which is now under greatest threat. These are most needed in reproduction, the most vulnerable stage of the lifecycle. Lifecycle nutritional and emotional nurture is the fundamental way to enhance people's happiness, peacefulness, health and ability. Many children's lifelong health and abilities are impaired through parental states of nutrition and health. Either parent may suffer unrecognized nutrient deficits, toxins or diseases, which may even prevent fertility. Powerful evidence for this is laid out in my previous article (Bradley & Bennett 1995; House 2007b). Poor nutrition early in development can both leave structure incomplete, and it can set gene-switches inappropriately for life. Attending to these factors, preconception care has been overcoming 80% of couples' fertility and reproductive problems, to achieve healthy full-term, full-weight babies. It avoids increased hazards of multiple births, low birthweight and problems associated with in-vitro-fertilization (IVF) or other assisted conception. The importance of conceiving and raising children with healthy food and physical activity, loving relations and management of stress levels, needs to be part of education at home, at school and throughout the lifecycle. This will enable people to bear children and raise them much freer of problems, closer to their genetic potential.

Zusammenfassung: Die Wechselwirkung zwischen Biosphäre und Gehirn hat großen Einfluss auf die menschliche Entwicklung. Zuerst trug die Biosphäre zur Entwicklung des Gehirns bei und zwar in einem solchen Ausmaß, dass dies nun in gefährlicher Weise die Biosphäre verändert. Diese Veränderungen schädigen wiederum das menschliche Gehirn. Die hierdurch verursachten Störungen verursachen in Europa die enorme jährliche Summe von 500 Milliarden Euro (Eur Fed Neur Socs 2005/2008). Die größten Ressourcen von für das Gehirn wesentlichen Nährstoffen kommt aus dem Meer, dessen ökologisches Gleichgewicht großen Bedrohungen ausgesetzt ist. Diese Nährstoffe werden besonders bei der Reproduktion gebraucht, der verletzbarsten Phase im Lebenslauf. Lebenslange Sicherung der emotionalen und stofflichen Ernährung ist das fundamentale Mittel zur Förderung des Wohlbefindens, der Friedfertigkeit, der Gesundheit und der Handlungsfähigkeit der Menschen. Die Gesundheit und Handlungsfähigkeit von vielen Kindern ist lebenslang durch ungünstige elterliche Gesundheits- und Ernährungsbedingungen geschwächt. Eindeutige Belege hierfür sind in einem früheren Artikel von mir dargestellt (House 2007b, s. auch Bradley, Bennett 1995). Mangelernährung in der frühen Entwicklung kann die Ausreifung des Organismus schädigen und kann ungünstige Gen-Veränderungen verursachen. Wegen dieser Gegebenheit kann präkonzeptionelle Vorsorge 80% der Fruchtbarkeits- und Reproduktionsprobleme überwinden, um gesunde, reife und normalgewichtige Babys zu

bekommen. Solche günstigen Bedingungen vermeiden überzufällige Mehrlingsgeburten, Mangelgeburten und die Probleme, die mit der IVF-Befruchtung verbunden sind. Die Bedeutung einer gesunden Empfängnis, einem gesunden Aufwachen von Kindern mit gesunder Ernährung, körperlicher Bewegungsmöglichkeit, liebevollen Beziehungen und einem guten Management von Stress muss Teil der Erziehung zu Hause, in der Schule und lebenslang sein. Dies wird den Menschen ermöglichen Kinder zu bekommen und groß zu ziehen, die viel freier von Problemen sind und näher zu ihrem genetischen Potential.

Keywords: environment, gene, nutrition, biochemical, brain, lifecycle, evolution

Abbreviations: DHA = docosahexaenoic acid, EPA = eicosapentaenoic acid, IVF = in-vitro-fertilization, Eur Fed Neur Socs = European Federation of Neurological Societies, PET = Positron Emission Tomography.

Introduction

Just 50 years ago, in 1958, I was marketing health products in a company producing pharmaceuticals, agrichemicals and foods. The Chairman said to me, 'Simon, your job is to sit in front of a blank piece of paper and see what comes.' My mind filled with the wide variety of ways from which we could profit immeasurably: farming more highly intensive and chemical; foods with more chemical satisfiers; pharmaceuticals with more chemical pacifiers. We could horribly distort organic life, the symbiosis and beauty of the natural world with dangerous risks to our own physiological systems, including our brains. This would allow major risks to our natural selection and evolution. Four years later the alarm was sounded in Rachel Carson's *Silent Spring* (Carson 1962). I had changed course, but these chemical excesses have of course been happening. Writing in the week of America's election of Barack Obama, we can see that the trend can begin to turn. It must. The soaring of mental health disorders in Europe to an annual cost of 500 billion Euros (Eur Fed Neur Socs 2005/2008) is the tip of an iceberg of general deterioration, potentially disruptive of society.

The biochemical dialogue between the biosphere and the human brain is now the most powerful non-natural factor affecting life on earth. Effects of environmental change on the brain are less obvious than the effects of the human brain on the environment. The brain is being changed primarily through changes to our food-chain that affect both the structure of our brains and epigenetic settings (Saugstad 2004), changes in which genes are biochemically silenced (de-activated) or activated by their immediate environment, rather than changes in gene sequence. Gene settings are likewise affected by emotions, positive and negative, and so subject to the pace and circumstances of life, particularly in reproduction. The most common form of silencing a gene is by methylation, addition of a CH₃ group – 1 carbon with 3 hydrogen atoms: activation is by its removal. At conception the new individual's genes are set according to which parent the gene derives from, the male or female 'allele'. Subsequently they may be reset by their environment. Overwhelming scientific evidence shows that prime factors are nutritional and emotional, also toxins and infections, and stress (Verny 2008; Verny & Weintraub 2001/2005). This resetting affects them and their replication. So the earlier resetting takes place the more cells will eventually be affected by the resetting,

hence a greater effect on the individual. All these have their worst effects early in development, at conception itself and in the months before and following.

The good news is our rapidly increasing knowledge for improving environment and health, particularly concerning reproduction and development. Education and motivation is urgent at professional and popular levels, relating to 4 main aspects:

1. Nutrients that were essential in evolution continue to be essential today.
2. The third agricultural revolution is essential.
3. Nurture from before conception is paramount.
4. Protecting brain development in embryo fetus and child is vital.
5. Education in lifecycle nurture and ecology will benefit all the world.

1. Nutrients that were essential in evolution continue to be essential today

Essential nutrients are those which our bodies cannot make. For instance some elements that nourish us originate from the Big Bang, stardust, metals such as zinc and magnesium, and other minerals such as selenium and iodine. Since our bodies cannot make them, they are 'essential' nutrients in the sense that they must be supplied.

Further examples of essential nutrients are compounds made by various other forms of organic life, such as vitamins and omega-3 oils. Two very important omega-3s, DHA and EPA (docosahexaenoic acid and eicosapentaenoic acid), are found in plenty only in aquatic sources – in algae, fish and marine mammals. DHA and EPA are both produced by phytoplankton and blue-green algae, whose photosynthesis produces oxygen – in such quantity that some 2 billion years ago the oxygen concentration began poisoning them. This spate of oxygen, however, gave rise to higher forms of oxygen-breathing life and then to the brain, for which DHA and EPA became the prime nutrients. We may wonder, as we increase quantity and variety of new chemicals, if they may induce and foster new life-forms, and how benign or otherwise they may be, to the human species, just as oxygen was not benign to the algae.

As land-bound mammals developed in size and sophistication, the bodies of the large animals, rhinoceros for instance, became too big for their available DHA, needed in every cell of the body. So the brain diminished. The squirrel, remaining small in body, has relatively a slightly larger brain than our own. The only large mammals to retain their relative brain-size were the marine mammals, such as dolphins and whales, and our human ancestors, who spread along the watersides of the world with fish and shellfish in plenty. Remains from our human evolution found on the dry savannah of the Rift Valley were recently re-dated to 200,000 years ago, when much of it was flooded, and some human finds were with fish remains. There would have been no shortage of DHA, of which the human brain needs well over 10% (Crawford & Marsh 1995, Broadhurst et al. 1998).

– *Conclusion 1. Understanding our evolution is key to our future.*

2. The third agricultural revolution is essential

Populations were extending along the shores of seas, rivers and lakes (Tobias 2002). Further expansion some 10,000 years ago led to movement inland and food scarcity causing people to start growing foods and herding animals. Finding agriculture an easier life than the hunter-gatherer's encouraged people to leave the rich resources of the waters-edge. The cost, however, of this first agricultural revolution was a loss of aquatic foods, particularly DHA, EPA, iodine and other essential nutrients, particularly minerals and trace elements necessary for enzymic processes.

The second revolution, into intensive farming, has enabled us to grow still more food, but nutritionally more seriously deficient, as well as introducing harmful excesses and toxins. Changing conditions continue to drive changes in us, just as conditions had driven the evolution of squirrel, rhinoceros and ape. Darwin's principle of natural selection (Darwin 1859) is familiar to everyone, but not all appreciate that underlying this was his principle of 'conditions of existence' – the effect of environment, we say, or substrate, bringing about changes in a species.

Now scarcity is beginning to drive a third and essential agricultural revolution, agriculture this time of the ocean-beds. On a grander scale than aquaculture, such as fish-farming, this ocean-bed agricultural revolution is to prevent and restore the terrible damage we have been doing to the oceans and ocean-beds, and to enhance them and their productivity. The debt is one of over-fishing, sea-bed wrecking with heavy bottom-trawling, even use of explosives. Further damage has been caused by effluents of fertilizers, slurry and sewage leading to dead-spots. Now several nations have begun planting corals and other vegetation. Some are strategically sinking obsolete ships to harbour sea-life. Full-scale cultivation to enhance the ocean-beds with marine life, combined with strict regulation of fishing and stocks, can bring back lost minerals into bio-cycles and promote fish-stocks and desirable algae growth, increasing availability of vitamins, DHA and EPA to the great benefit, apart from anything else, of human health, mental particularly.

Our genetic potential is in jeopardy. To sustain, let alone enhance it, means looking back before these revolutions to our evolution lifestyle, to assess scientifically the effects of the accelerating changes; not to ape the past but to provide nutrition appropriate to our genes. We have to face the evidence that we are affected not only by our own environment, but at least by our grandparents' and great-grandparents' diet and toxins, while some epigenetic settings, at least, are transmitted further down the generations (Lipton 2001; Pembrey 2006; Pembrey et al. 2006; Pert 1998; Monk 1995).

Protection of our gene-pool, by keeping closer to some aspects of our evolutionary diet and lifestyle, will receive increasing awareness.

– Conclusion 2. Ocean-bed agriculture is essential to safety of our genes.

3. Nurture from before conception is paramount

Having referred to the beginning, the Big Bang, for some nutrients, we now look to another beginning, that of the human individual, to the genetic beginning of

sperm and ovum, fusion and early development, the most vulnerable stage in the lifecycle.

To avoid repetition, for sections 3. and 4. of my presentation, I refer you to my last article in the Journal: *The Science of Nurture*, both nutritional and emotional: *Ways to fulfil genetic potential* (House 2007b). This lays out the powerful biochemical and physiological evidence of how the environment of both parents, from before conception, is affecting their offspring's structural development and epigenetic settings, and so the entire lifelong health and ability of the child-to-be. The article begins with the nurturing within each parent of sperm and ovum in preparation for conception, continuing through pregnancy and the child's development. Fully controlled nutritional trials, some from conception, some later, show truly powerful effects on brain development, affecting future feelings and behaviour, intelligence and skills of the child.

The power of sound nutrition demonstrated in these trials is underlined by the success of clinical work with infertile and subfertile couples that contrasts with the rush to in-vitro-fertilization (IVF), often involving serious hassle, major expense, problems for the woman and sometimes worse for the child. The danger may be that just short of infertility may be likely miscarriage, stillbirth or malformation. For most couples a natural alternative is demonstrated to be safer and more effective. Couples in their thousands, who have suffered infertility, miscarriages, stillbirths and malformations, have achieved 80–90% success with fully healthy babies, purely by skilled attention to the parents' health. At a tenth the price of IVF, the woman's and the man's status of nutrition and health is checked for hazards often hidden and guidance given. In 1990–1992, in clinical practice monitored by Surrey University, success was almost 90% (Bradley & Bennett 1995). That was before folic acid and other nutrients were widely supplemented from around conception. Since then, unsurprisingly, this success rate has dropped to nearer 80% (Barnes 2008), but this still appears to be at least double the births success of IVF, (Fernández-Gonzalez et al. 2007, Allen et al. 2008) without increasing problems. On the contrary, such improvement of health and nutrition status substantially increases the probability of a healthy fully developed baby (Kajantie 2006).

Some longitudinal trials have shown children's various abilities to correlate with fish consumption in pregnancy. Other trials have shown their behaviour and learning to correlate with supplemented DHA and EPA. Strangely, although vitamins and minerals have been supplemented from before conception, no one yet seems to have included DHA and EPA before mid-pregnancy. For 3 reasons there appears to be every advantage of trials including DHA and EPA in relation to pregnancy as early as possible: DHA is needed in every cell of the body; there is a common dietary shortfall; the woman needs to build up body-stores in advance of pregnancy (Ridgway & House 2006; House 2007a).

– *Conclusion 3. We can protect the embryo.*

4. Protecting brain development in embryo, fetus and child is vital

Ensuring the full complement of essential nutrients is basic. Of most concern are vitamins, minerals and DHA & EPA. Supplements are not a complete substitute

for foods. They are needed in research studies for better control. They are needed in a critical food shortage or when nutrients in soils and foods are depleted.

Childbearing needs to be monitored to protect brain development. Public understanding of brain developmental stages in childhood and adolescence needs to be understood too. Studies have also shown specific nutritional supplements to powerfully benefit children with behavioural problems, also young adult prisoners with a 37% reduction of violence (Eur Fed Neur Socs 2005/2008). The nutrition link with mood and behaviour can further be linked with drug abuse and the metabolic syndrome (Virmani et al. 2006).

One reason why late adolescence is a peak for violence is the same as the reason why the larger land mammals, with the exception of humans, evolved with relatively smaller brains. The adolescent male's large body grows so fast that it seriously competes with the brain for key nutrients, especially DHA. Supporting evidence is the correlation of homicide mortality rates with low seafood consumption and the differences in brain responses between murderers and controls shown by Positron Emission Tomography (PET) scans. Even this late in development when young offenders can nourish themselves they can find peace.

Since emotions became understood biochemically, particularly in relation to childbearing, there has been common ground between nutrition and psychology. After 9/11 children who had then been in the third trimester turned out to be more stressed than those earlier in gestation (Yehuda et al. 2005). A similar pattern is seen in trial animals prenatally stressed. They show greater and prolonged corticosterone response to a new stressor, and behave more anxiously. Rats stressed in pregnancy have offspring with fewer corticosteroid receptors in the hippocampus (Barbazanges et al. 1996, Henry et al. 1994). In both nutrition and psychology, epigenetics has begun to clarify the effects of parental environment on the child and, in some respects, subsequent generations. To appreciate the strength of evidence behind these statements please see my previous article (House SH 2007b).

The visible obesity pandemic has raised the public alarm. Overweight and obesity are an aspect of the 'metabolic syndrome', which is induced early through inappropriate diet and/or under-activity, and can lead to diabetes and cardiovascular disorders as well as obesity (Park 2008). But associated with these is the largest and most serious burden of ill health of all, mental disorders (McIntyre et al. 2007). Evidence indicates that if the pre- and perinatal and nutrition societies had their way, these pandemics could be decimated. Reproduction is the stage most worth preparing for throughout life – by both genders.

– Conclusion 4. Families can safeguard health and prevent much disease.

5. Education in lifecycle nurture and ecology will benefit all the world

These metabolic syndrome pandemics are the result of nutritional diversion from our evolutionary path too sudden for genetic adaptation. Of the nutritional changes from waterside through agriculture, none has been more drastic than the recent changes to intensive farming, junk-foods and the added surge of medicines. Diminished recycling of organic matter, with loss of microbial life, has caused nutrient-depletion of soils, and therefore of vegetables, fruit and fat farmed ani-

mals. These deficiencies, combined with our sudden switch to fatty, sugary, salty foods, has led to our Western world pandemic.

Our impoverished food-chain calls for the recycling of nutrients. In Europe soil nutrients are depleted by 72%, and worse in North America. In the UK zinc depleted by 59% over only 13 years up to 1991. This is one of several seriously depleted nutrients supplemented so successfully in Czeizel's preconception trials, spelt out in my previous article (House 2007b). At the moment many of our precious nutrients are washed out to sea, not only by natural erosion, but in sewage, farm slurry, and questionable fertilizers. There, rather than benefiting the food-chain, they damage ocean beds and marine life (Diaz Rutger 2008), multiplying undesirable blooms of algae that die and suffocate marine life. They have already left 400 dead coastal-zones (Stramma 2008). Apart from the damage itself, what could be worse for our own mental health, just as we are waking up to the importance of marine foods?

Children need education about lifecycle nurture and ecology, particularly on the environmental effects on our mental health. Empower them to grow up healthy and understand how we all need to care for the genetic potential of our future generations. Bringing this home to the child, in 'apples and pears' terms, 'carrots and spinach', this means eating the UK-recommended '5-a-day' fruits and vegetables and understanding the reasons that this is so important. The hunter-gatherer's healthy chase must be replaced by physical activities, football, cycling, outdoor life. Children need to learn that a healthy sperm and ovum are needed for a healthy child, and people need to grow up healthy to produce them.

– *Conclusion 5. Education in lifecycle health is a global need.*

Final conclusion

A new 'tree of health' is needed beginning from the health of genesis of sperm and ovum, conception and so on, recognizing in each person's primal history the biochemical impact on their genes, conscious of environment of nutrition, emotions, toxins and disease stage by stage through development. This perspective shows up connections between widely differing symptoms that in relate to a common basic cause, which might be endemic in a population, yet manifesting itself in varying ways according to more local conditions or family genetics. The more that the new insights in genetics and epigenetics pervade general medicine, the more the root causes of disease will become clear, rather than confounding the issue by tackling merely the symptoms with damaging medicines. So often the causes to be tackled lie beyond the individual, such as in the way the planet and our food-chain are treated in our fearful and greedy rush to some fantasy of a better life. But following recent global blunders, in a dramatic leadership change, I sense a paradigm shift; perhaps a new readiness to hear the prophets of ecology, nutrition and of pre- and perinatology.

References

- Additional references are in my *The Science of Nurture*. Int J of Prenatal and Perinatal Psychology and Medicine 19(1/2): 55–71, which this article overlaps.
- Allen C, Bowdin S, Harrison RF, Sutcliffe AG, Brueton L, Kirby G, Kirkman-Brown J, Barrett C, Reardon W, Maher E (2008) Pregnancy and perinatal outcomes after assisted reproduction: a comparative study. *Irish Journal of Medical Science* 177(3)
- Barbazanges A, Piazza PV, Le Moal M, Maccari S (1996) Maternal glucocorticoid secretion mediates long-term effects of prenatal stress. *J Neurosci* 16(12): 3943–3959
- Bradley SG, Bennett N (1995) Preparation for Pregnancy (Foresight). Argyll, Scotland
- Broadhurst CL, Cunnane SC, Crawford MA (1998) Rift Valley lake fish and shellfish provided brain-specific nutrition for early Homo. *British Journal of Nutrition* 79: 3–21
- Carson R (1962) *Silent Spring*. Houghton, Boston MA
- Crawford M, Marsh D (1995) *Nutrition and Evolution*. Keats, New Canaan CT
- Darwin C (1859) *Origin of the Species*. John Murray, London 1868
- Diaz R, Rutger R (2008) Marine ecology, University of Gothenburg, <http://www.guardian.co.uk/environment/2008/aug/14/pollution.endangeredhabitats>
- European Federation of Neurological Societies (2005/2008) Executive summary, *European Journal of Neurology* 12(s1): x–xi
<http://www3.interscience.wiley.com/journal/120827996/abstract?>
- Fernández-Gonzalez R, Ramirez MA, Bilbao A, De Fonseca FR, Gutiérrez-Adán A (2007) Suboptimal in vitro culture conditions: an epigenetic origin of long-term health effects. *Molecular Reproduction and Development* 74(9): 1149–1156
- Foresight – Belinda Barnes, founder director, in personal communication
- Henry C, Kabbaj M, Simon H, Le Moal M, Maccari S (1994) Prenatal stress increases the hypothalamo-pituitary-adrenal axis response in young and adult rats. *J Neuroendocrinol* 6(3): 341–345
- House SH (2007a) Nuturing the brain, nutritionally and emotionally, from before conception to late adolescence. In *Generating Healthy Brains. Nutrition and Health* 19(1/2)
- House SH (2007b) The Science of nurture, both nutritional and emotional: ways to fulfil genetic potential. *Int J of Prenatal and Perinatal Psychology and Medicine* 19(1/2): 55–71
- Kajantie E (2006) Fetal origins of stress-related adult disease. *Ann N Y Acad Sci* 1083: 11–27
- Lipton BH (2001) Nature, Nurture and Human Development. *J Prenatal and Perinatal Psychology and Health* 16(2): 167–180
- McIntyre RS, Soczynska JK, Konarski JZ, Woldeyohannes HO, Law CW, Miranda A, Fulgosi D, Kennedy SH (2007) Should Depressive Syndromes Be Reclassified as “Metabolic Syndrome Type II”? *Ann Clin Psychiatry* 19(4): 257–264
- Monk M (1995) Epigenetic programming of differential gene expression in development and evolution. *Developmental Genetics* 17: 188–197
- Park A (2008) Overweight Children: Living Large. *TIME*, Jun 12.
<http://www.corporate.s2h.com/documents/Time+CNNOverweightChildren-LivingLarge.pdf>
- Pembrey M (2006) The Ghost in Your Genes.
<http://www.bbc.co.uk/sn/tvradio/programmes/horizon/ghostgenes.shtml>
- Pembrey ME, Bygren LO, Kaati G, Edvinsson S, Northstone K, Sjöström M, Golding J, ALSPAC Study Team (2006) Sex-specific, male-line transgenerational responses in humans. *Eur J Hum Genet* 14(2): 159–166
- Pert C (1998) *Molecules of Emotions*. Simon and Schuster, London
- Ridgway R, House SH (2006) *The Unborn Child*. Karnac Books, London

- Saugstad LF (2004) From superior adaptation and function to brain dysfunction – the neglect of epigenetic factors. *Nutr Health* 18(1): 3–27
- Stramma L (2008) Leibniz Institute of Marine Sciences in Kiel. Science. http://www.intute.ac.uk/sciences/spotlight/issue60/ocean_starvation.html
- Tobias PV (2002) Some aspects of the multifaceted dependence of early humanity on water. *Nutr Health* 16(1): 13–17
- Verny TR in House SH Ed (2008) Moscow 2007 Coordinated Congress Summaries “The Prenatal Child and Society”. *Int J of Prenatal and Perinatal Psychology and Medicine* 20(1/2): 42–76
- Verny TR, Weintraub P (2001/2005) The Art and Science of Parenting from Conception through Infancy. <http://www.pregnancy.org/article.php?sid=403>
- Virmani A, Binienda Z, Ali S, Gaetani F (2006) Links between nutrition, drug abuse, and the metabolic syndrome. *Ann NY Acad Sci* 1074(Aug): 303–314
- Yehuda R, Engel SM, Brand SR, Seckl J, Marcus SM, Berkowitz GS (2005) Transgenerational Effects of Posttraumatic Stress Disorder in Babies of Mothers Exposed to the World Trade Center Attacks during Pregnancy. *The Journal of Clinical Endocrinology & Metabolism* 90(7): 4115–4118

Correspondence address: *Simon H. House*, MA, 22 Stanley Street, Southsea, Portsmouth, PO5 2DS, UK, E-Mail shhouse@ntlworld.com

Presented at the ISPPM Annual Congresses, Heidelberg 2008 extending Moscow 2007 presentation.