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Obstetrical Implications of Waterside Hypotheses

Michel Odent, MD

Abstract: This article addresses the question, "What are the waterside hypotheses of human evolution"? The environments our Homo Sapiens ancestors adapted to through the evolutionary process remain to a certain extent unknown and open to theoretical investigation. When we do such investigation, it is revealed that there are obstetrical implications of the waterside hypotheses that also bear investigation. This article begins to make the important connections.

Keywords: Pitocin, Syntocinon, Induction, Biochemical Communication, Prevention of Premature Birth, Traditional Cultures

It is well accepted that our ancestors separated from the other members of the chimpanzee family about five or six millions years ago. The common chimpanzees remained adapted to the tropical rainforests of Central Africa, while the bonobos pygmy chimpanzees) remained adapted to the flooded forests south of the river Congo. Paradoxically, the environments Homo ancestors adapted to through the evolutionary process remain to a certain extent unknown. Any theory of the emergence of Homo sapiens must take into account what we may consider, in the scientific context of the 21st century, the most intriguing aspect of human nature. This humanfeature can be summarized in scientific language. It is the association of a huge highly developed brain with a weak delta 4 desaturation capacity. This can easily be translated in lay language: the human body is not very efficient at making a molecule that is essential to feed the brain. The suggested conclusion is that ideally this molecule should be included in the food consumed by human beings. This molecule, commonly called DHA, is a very long chain polyunsaturated fatty acid of the omega 3 family (22 carbons and 6 double bonds). The point is that this molecule is preformed, abundant, and ready for use in the seafood

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chain only. This fact indicates that our ancestors became adapted to the coast at crucial phases of their evolutionary process.

In general, the coastal food chain is the only one which can provide all the essential nutrients needed to develop a gigantic brain: not only very long chain, polyunsaturated fatty acids of the Omega-3 family, but also iodine, a good balance in other brain selective minerals such as iron, copper, zinc, magnesium and selenium, and also vitamins, particularly vitamin D. After all, it is difficult to believe that, after leaving the trees, our clever and curious ancestors did not discover the richness of the coastal food chain, bearing in mind that the bones of the famous Lucy were found among turtle and crocodile eggs, and crab claws.

Furthermore we have evidence to suggest that during a recent phase in the evolution of our species, about 164,000 years ago, our ancestors included in their diet sources of marine life, particularly shellfish. This is the conclusion of studies conducted at Pinnacle Point, on the south coast of South Africa (Marean, Bar-Matthews, & Bernatchez, 2007).

Apart from brain size there are dozens of other features which make us different from our very close relatives in the chimpanzee family; nakedness, a layer of fat attached to the skin, a comparatively low basal body temperature, depleting our body in salt and water for thermo-regulation, bipedality, streamlined body shape, face to face copulation, prominent nose, large empty sinuses on each side of the nasal cavities, low larynx, reduced number of red blood cells, anatomical particularities of hands and feet, multi-pyramidal kidney medullas, and specific colour vision being among the main differences. All these features are suggestive of adaptation to a semi-aquatic environment.

Today, all chapters of human anatomy, physiology, behavior, pathology, and evolutionary medicine must be rewritten in the light of the waterside hypotheses. This new vision of homo sapiens was first proposed independently by Max Westenhofer in Berlin (1942) and by Alister Hardy in Oxford (1960), but it is the British science writer Elaine Morgan who has championed the cause in her books (1982; 1990; 2008) and in the seminars she has organized in order to constantly update and strengthen the theory. A collective book is now in preparation, edited by Mario Vaneechoutte, Algis Kuliukas, and Marc Verhaegen. This gave me an opportunity to focus on the obstetrical implications of this new vision of human nature.

Obstetrical Implications

Health professionals involved in pregnancy and childbirth are in a position to combine fruitful specific perspectives to study human nature. On the one hand, a renewed theoretical context can influence the practices of obstetrics and midwifery. On the other hand, the point of view of practitioners can help evaluating the value of new theories.

Renewed Scientific Context

Since the middle of the twentieth century, there has been a continuous dominant style of antenatal care based on the detection of pathological conditions and abnormalities through standardised batteries of tests. In an evolving scientific context there is a new tendency to enlarge this framework further. An overview of the Primal Health Research Database will convince anyone that our health is to a great extent shaped in the womb. We can reach similar conclusions via concepts that are becoming familiar in the scientific literature, especially the concepts of gene expression, gene silencing, and epigenetic modulation; they indicate several phases of fetal life as critical for gene-environment interaction. In such a context more and more prenatal practitioners are gradually developing a new interest in several aspects of maternal lifestyle that can influence fetal growth and fetal development.

In the early 1980s, pioneers such as Michael Crawford and Stephen Cunnane (2003) renewed what was called the "aquatic ape theory" by phrasing new questions about hominid evolution and nutritional influences inducing a spectacular brain development. This evolutionary perspective helped me realise that brain development is also a priority from an ontogenetic perspective and that there is a brain growth spurt during the second half of fetal life. At that time it was unusual, in the context of antenatal care, to consider the issue of nutrition, and the rare written documents on this matter focused on calories, proteins, maternal weight and birth weight.

Our Own Studies

When I could retire from my busy practice in a French state hospital, I started a study in a London hospital (Whipps Cross). The objective was to evaluate the possible effects in the perinatal period of simply encouraging pregnant women to consume sea fish (Odent, McMillan, & Kimmel, 1996). Four hundred and ninety-nine pregnant women attending selected clinics for antenatal care before 20 weeks of

gestation were offered 20-minutes of nutritional advice. For each woman interviewed a corresponding control was established. There was one highly significant difference between the two groups in the perinatal period: the mean neonatal head circumference was greater in the study group (34.65 cm vs. 34.45 cm. 95% CI 0.01-0.39). There was no eclampsia and no recorded preeclamptic toxaemia in the study group; in the control group there was one eclampsia with convulsions and two severe preeclamptic toxaemia. The other differences were not statistically significant: the mean birth weight was slightly higher in the study group (3349g vs. 3284g) and the differences persisted after adjusting for gestational age (85g/week vs. 83g/week).

Our Whipps Cross study was replicated and enlarged at Wolverhampton New Cross Hospital (Meeson, 2007). Again, the most significant difference was related to head circumference at birth. Among the 1,607 cases in the study group, the mean head circumference was 34.54 cm, vs. 34.32 cm; among the 1,078 cases in the control group (95% CI 0.10-0.35. $p<0.001$). The statistical significance remained the same after adjustment for gestational age and sex. The mean body length was significantly increased in the study group after the same adjustments (51.77 vs. 51.50. $p<0.001$). Although the birth weight of babies in the intervention group was 38g higher, this was not statistically significant. The rates of preeclampsia are low in this population and were not evaluated because this diagnosis was not mentioned in the local birth registers.

In these two British studies pregnant women seen before twenty weeks gestation were encouraged to consume sea fish. In order to sensitize the effects of possible interventions on dietary habits, we conducted a pilot randomised controlled trial at Alexander Fleming hospital in the outskirts of Rio de Janeiro. In this hospital, which serves a low-income population living mostly in "favelas," the rates of birth complications are particularly high. The consumption of sea fish in this population is negligible. Only primigravidas seen before 15 weeks gestation (vs. 20 weeks in previous studies) were enrolled. Instead of simply being encouraged to consume sea fish, those women in the study group were invited once a week to participate in socialising sessions, during which they were eating sardine sandwiches and given a can of sardines they could consume at home. Those in the control group were also invited to share activities with other pregnant women, but the focus was not on nutrition and they were not given any food.

With this research protocol in such a low-income population some differences could already be detected in the perinatal period after

enrolling only 104 women (51 in the study group and 53 in the control group). We observed a tendency towards a larger standard deviation regarding head circumference and weight at birth. In other words, there were more extreme cases in the control group. This suggests that further studies should focus on standard deviations rather than mean head circumference and birth weight. There was also a tendency for more caesareans in the control group (48% vs. 44%). Interestingly, the only statistically significant differences were about eclampsia and severe hypertensive disorders. There was one case of eclampsia with convulsions and four severe hypertensive disorders in the control group vs. zero incidence in the study group.

Eclampsia as the "Disease of Theories"

Several puzzling aspects of the disease challenge the widespread belief that reduced uteroplacental perfusion is the central pathophysiological process in preeclampsia. For example, a study looking at 97,270 births in 35 hospitals in Alberta, Canada, revealed that there is a significant association between preeclampsia and large-for-gestational-age infants, in addition to the well-known association with small-for-gestational age infants (Xiong, Demianczuk, Buekens, & Saunders, 2000). Such findings are more easily interpreted if this multifactorial syndrome is presented as an expression of a maternal/fetal conflict. From this perspective, it is plausible that a high demand for nutrients by a large fetus can be the root of conflict (Odent, 2001). Faulty placentation, inadequate maternal nutrition, and certain combinations of maternal and fetal genotypes are other factors that independently can increase the conflict. Since mother and fetus do not carry identical gene sets, maternal and fetal interests are not always in harmony. The nature and the expression of such conflicts differ according to the species of mammals.

For example, among various mammals, including dogs, the so-called eclampsia is related to hypocalcemia (it is a "perinatal tetany"). Of course, where dogs are concerned, the priority at the end of pregnancy and at the beginning of lactation, is the development of the bones of the offspring, which are much more mature at birth than the bones of other mammals. Treatment is based on the intravenous administration of calcium. Where ewes are concerned, veterinarians use the terms "pregnancy disease" or "pregnancy toxaemia." Among these herbivorous mammals the fetus is supplied almost entirely by glucose, consuming 40% of the blood sugar produced by the mother. The disease occurs in late pregnancy. It is more common in the case of

thin ewes pregnant with multiple fetuses. It is characterized by a destabilization of the glycaemia that leads to fat catabolism (this disease has also been called "lambing ketosis"). Treatment is based on the administration of glucose.

Interspecies comparisons encourage us to raise new questions concerning the potential for gestational conflicts among humans. The spectacular brain growth spurt during the second half of fetal life is a specifically human trait. A conflict between the demands of the fetus and what the mother can provide without creating her own imbalances leads us to consider first the needs of the developing brain.

Today, the specific nutritional needs of the developing brain are well documented. It is well known that iodine is a "brain selective nutrient" (since it is necessary for thyroid hormone production), and that human beings are unable to conserve iodine. It is also well known that docosahexaenoic acid (DHA = the very long chain polyunsaturated fatty acid of the omega 3 family with 22 carbons and 6 double bonds) is the brain selective fatty acid. However, the chain elongation and desaturation pathways are not very efficient among humans. The importance of iron, copper, zinc, and selenium as brain selective minerals is also well documented; evidence for the brain's need for vitamin D includes the wide distribution of vitamin D receptors throughout the brain. From an overview of the specific nutritional requirements of the developing brain clearly pregnant women who do not have access to the sea food chain may have difficulties satisfying such fetal needs and are therefore more at risk of metabolic imbalances, particularly preeclampsia-eclampsia.

The concept of maternal-fetal conflicts directs us to establish a new classification of the numerous well-documented biological imbalances associated with preeclampsia among humans (Odent, 2000b). The first step should be to look at the status of maternal fatty acids at the end of normal pregnancy and in those pregnancies complicated by preeclampsia. We should look particularly at the group of long-chain omega 3 polyunsaturates, which includes DHA and eicosapentaenoic acid (EPA = the polyunsaturated fatty acid of the omega 3 family with 20 carbones and 5 double bonds).

It seems that the central imbalance in human preeclampsia is the enormous discrepancy between the maternal plasma levels of DHA—the 'brain specific fatty acid'—and EPA. In preeclampsia, the level of DHA is not significantly decreased, whereas the level of the parent molecule EPA is about 10 times lower than in normal pregnancy (Wang, Kay, & Killam, 1991). These are exactly the data we would expect when assuming that brain development is a priority among

humans. Such data are confirmed by the "Curacao study" (Velzing-Aarts, van der Klis, van der Dijs, & Muskiet, 1999), which looked at the fatty acid compositions of maternal and umbilical cord platelets from preeclamptic women. Whatever the circumstances, the levels of DHA remain stable. This fact is notable, keeping in mind the low delta 4 - desaturase activity (i.e. the difficulties to make the brain specific fatty acid) among humans (Sanders & Younger, 1981). The price of a stable DHA is an imbalance inside the omega 3 family that is at the root of a series of further imbalances.

We can understand the onset of a vicious circle when the demand in long-chain fatty acids is at its greatest: at that stage, if the amount polyunsaturates available is low, the priority is to keep the level of DHA as stable as possible.

The use of biochemical markers of dietary intakes of lipids has demonstrated that a diet poor in omega 3 fatty acids is a risk factor for preeclampsia. Studies of the erythrocyte fatty acids profile found that women with the lowest levels of omega 3 fatty acids were 7.6 times more likely to have had their pregnancies complicated by preeclampsia as compared to those women with the highest levels (Williams, Zingheim, King, & Zebelman, 1995). A 15% increase in the ratio of omega 3 to omega 6 was associated with a 46% reduction in the risk of preeclampsia. Evaluating the fatty acid compositions of maternal platelets is another way to use biological markers of dietary fat intake. According to the Curacao study (Velzing-Aarts et al, 1999), the ratio of arachidonic acid (AA = the omega 6 polyunsaturate with 20 carbons and 4 double bonds) to EPA is significantly higher in maternal platelets of preeclamptic women (109.13 vs 78.13; $P < .05$).

These significant concordant data suggest that when the amount of omega 3 available is low, the first compensatory effect—in order to maintain an adequate supply of DHA available—is the collapse of the level of the parent molecule EPA: this precipitating factor explains the well-known imbalances in the system of prostaglandins and particularly the decreased ratio of prostacyclin to thromboxane-2. When the level of EPA is diminished, there is no production of the physiologically inactive thromboxane-3. This leads to an overproduction of the physiologically-active thromboxane-2, through a mechanism of enzymatic competition. Moreover, when the level of EPA is low, there is no production of the physiologically active prostacyclin-3.

The concept of maternal-fetal conflict leads us to look also at the thyroid functions of preclamptic mothers and of their babies. In general the level of free thyroxine is low, while the level of thyroid-stimulating hormone is high. A low total triiodothyronine level has

been reported in preeclamptic mothers of low birth weight babies (Lao, Chin, Swaminathan, & Lam, 1990). The alterations of the levels of thyroid hormones reflect the severity of the disease. Furthermore preeclampsia is associated with fetal and neonatal thyroid enlargement and elevated free triiodothyronine level (Narin, Kurtoglu, Basbug, Caksen, Kafali, et al, 1999).

Our theory of preeclampsia can address the many puzzling or unexplained aspects of the disease. One is that preeclampsia is principally a disease of first pregnancies. We must recall that the metabolism of omega 3 fatty acids is influenced by parity (Carlson & Salem, 1991; Al, van Huseligen, & Hornstra, 1997). The DHA content of cord blood phospholipids depends on birth order; in other words, the capacity to provide preformed DHA is depleted with repeated pregnancies. It is as if brain development is a higher priority in the case of a first baby. The association of preeclampsia with lower infant mortality in preterm babies may also be considered intriguing. This has been clearly demonstrated by the USA Birth and Infant death registration dataset in 1995-2000 (among a total of 17,432,987 births) (Chen, Wen, Smith, Yang, & Walker, 2006). Our interpretation is that the consequence of preserving the needs of the developing fetus at any price may be a maternal disease, but the risk of infant death is reduced. We can offer a similar interpretation of the reported association of preeclampsia with a reduced risk of cerebral palsy (Murphy, Wellers, MacKenzie, Yudkin, & Johnson, 1995).

After presenting Homo sapiens as a primate with a highly developed brain, and after recalling the concept of brain selective nutrients, and after taking further into account the concept of maternal fetal conflict, as well as mentioning the enormous geographical differences in the rates of preeclampsia, it is worth noting that our pilot study in Rio de Janeiro is the first prospective controlled trial of the effects of giving sea food to pregnant women on perinatal outcomes and particularly rates of preeclampsia.

At the present time, the medical literature is inundated with studies about pre-eclampsia conducted in developed countries. These studies investigate mild forms of the disease. They look in particular at genetic factors and they try to develop prediction tests, searching for measurable manifestations of abnormal placentation that is assumed to initiate this disorder. Many of these efforts have focused on biochemical markers, primarily those suggesting endothelial dysfunction and activation of coagulation. These current studies cannot lead to significant advances in our understanding of the pathophysiological processes. The only studies about nutritional

factors look at the effects of nutrients, but not at the effects of whole food. For example the effects of vitamin C and E (Poston, Brilley, Seed, Kelly, Shennan et al, 2006)), of magnesium (Eclampsia Trial Collaborative Group, 1995), calcium (Bucher, Guyatt, Cook, Hatala, Cook, et al, 1996), and zinc (Kiilhoma, Paul, Pakarinen, & Gronroos, 1984) have been explored. The vitamin D-preeclampsia relation has been investigated (Appel, Miller, Seidler, & Whelton, 1993; Bodnar, Catov, Simhan, Holick, Powers, et al, 2007). Of course there have been studies of fish oil supplementation. Most of them began during the second half of pregnancy. Based on the results of several studies, preeclampsia has not been dissociated from the framework of pregnancy-induced hypertension. For many reasons, it is therefore not surprising that meta-analyses (Appel et al, 1993) and systemic reviews (Duley, 1994; Makrides & Gibson, 2000) have found insufficient evidence of the effects of fish oil on the risk of preeclampsia. In fact, most studies were too small to even address the issue of preeclampsia. It is remarkable that the only study that demonstrated highly significant effects of fish oil supplementation on the risk of "toxemia" was conducted in London by the People's League of Health during 1938-9, at a time when the rates of severe "toxemia" were in the region of 6%. This controlled trial was saved from oblivion by S.F. Olsen and N.J. Secher (1990). The authors randomized 5,644 pregnant women to receive or not receive a dietary supplement containing vitamins, minerals, and halibut liver oil from about week 20 of pregnancy. A significant effect of treatment was seen in primigravidas, with a 31.1% reduction in the incidence of "toxaemia."

This "disease of theories" should be looked at from new perspective in the age of the Waterside hypotheses. Studies of preeclampsia in the framework of evolutionary medicine are needed (Odent, 1995). Is eclampsia the price some human beings have to pay for having a large brain while they are more or less separated from the sea food chain?

Vernix Caseosa: An Intriguing Particularity of Human Neonates

It is commonplace to claim that only the skin of human foetuses and neonates is covered by vernix caseosa, the greasy white substance secreted by the baby's sebaceous glands during fetal life. In many cultures the vernix was denied any role and routinely wiped away.

The Waterside Hypotheses now offer an opportunity to stimulate our interest in this human particularity, since Don Bowen, a marine biologist from Nova Scotia, revealed that the pups of seals also have

vernix. Interestingly, he noticed that harbour seals, which swim with their mothers within minutes of being born, have more vernix than other seals, which do not swim for at least 10 days. I reviewed these data with reference to the composition of vernix. It appears that although approximately 80% of vernix is water, it still has high viscosity, suggesting that its water must reside within a highly structured state which is conferred by the abundance of water-filled fetal corneocytes. These fetal corneocytes act as "cellular sponges" that prevent water from moving across the skin, whereas sebaceous lipids provide a hydrophobic barrier.

By combining these perspectives we suggest that vernix caseosa might be interpreted as a transitory protection against immersion in non-isotonic water. We should at least remember that vernix caseosa is a common point between Homo sapiens and mammals adapted to the sea, while it is unknown among land mammals.

Learning from Birthing Pools

In the early 1990s, when we became more familiar with the concept of antagonism between hormones of the adrenaline family (stress hormones) and oxytocin (the key hormone in parturition), I started to investigate the management of a common pathological situation in midwifery and obstetrics. It is the "failure to progress" in the middle of cervical dilation, associated with intense lumbar pain. In this case, the pain appears as an obstacle to cervical dilation. I was considering non-pharmacological methods of pain relief. This is how I introduced the concept of "lumbar reflexotherapy," based on the "gate control theory of pain." Intracutaneous injections of sterile water in a precise zone of the lumbar region innervated by the posterior branch of the twelve dorsal nerve can block the visceral pain coming from the contracting uterus (Odent, 1975). I also proposed immersion in water at body temperature as a way to relieve pain, to reduce the level of stress hormones, and thus achieve more effective uterine contractions.

Taking into account the physiological perspective, and also the strong attraction to water expressed by many labouring women, I eventually bought a blue inflatable garden wading pool. Thus began the history of birthing pools in hospitals (Odent, 2000a). As soon as the birthing pool was installed new strategies became possible. When a woman in hard labour was demanding painkillers, we had something else to offer other than the injection of an analgesic drug (this was before the age of epidural analgesia). We could introduce the mother-to-be to the aquatic birthing room, so that she could observe and hear

beautiful blue water filling the pool. The room was painted blue, with dolphins on the walls. From that time the question was no longer: "When will you give me a pain killer?" It was more often than not, "How long does it take to fill the pool?" The first lesson concerned the importance of the time when the woman in labour is anticipating the bath: the dilation of the cervix can already progress dramatically before water immersion—if the aquatic environment is associated with privacy. It is like the sudden release of brakes . We witnessed one of the many magic effects of water on human beings...a profound power that cannot be easily explained with the language of physiologists (Odent, 1990). At the time of the plastic pool (before we installed a solid pool), women were not influenced by the media or by what they read in books about childbirth. Their behaviour was spontaneous and thus we learned about the genuine effects of a water environment. A the typical scenario (with many possible variations) was the case of a woman entering the pool in hard labour around 5 cm, spending an hour or two in water and then feeling the need to get out of the pool when the contractions were becoming less and less effective. This going back to the dry land often induced a short series of irresistible and powerful contractions so that the baby was born within several minutes.

One day, a mother-to-be had not been in water for long when suddenly she had two irresistible contractions and the baby was born before she felt any need to get out of the pool. While giving birth, this woman was really "on another planet." Clearly, in that altered state of consciousness associated with hard labour, she intuitively knew that her baby could be born safely under water. There was no panic. It is as if a deep-rooted knowing could express itself as soon as the intellect and its knowledge was set aside. Such births happened again (Odent, 1990). From that time many journalists, reporters. and photographers were fascinated by babies being born in water. They were indifferent to all other aspects of our unconventional practices. After a short period of surprise and even frustration, I concluded that good journalists are experts in Human Nature. They know how to attract the attention of their readers or their viewers. They have this intuitive knowledge that there is a special relationship between human beings and water. By referring to this historical phase of the use of birthing pools, we offer food for thought in the age of Waterside Hypotheses.

Eating the Placenta

It seems that in our species "placentophagy" has never been

instinctive. If it had been at any time in the history of humanity, we should find traces of this behaviour in myths, legends, and reports from preliterate and pre-agricultural societies. I know of women who had reached a very instinctive state of consciousness in the perinatal period, behaving as if "on another planet," and overcoming a great part of their cultural conditioning. Yet none of them had ever expressed a tendency to bring the placenta toward her mouth. Modern women who occasionally have eaten pieces of placenta were inspired by theories, such as the theory that it might prevent postnatal depression. Scientific interest in the placenta has recently inspired such theories leading to a form of human placentophagy based on rational considerations. For example, the discovery by Kristal (Abbott, Thompson, Ferguson, Doerr, Tarapacki et al, 1991) of a placental substance that makes endorphins more effective (Placental Opioid-Enhancing Factor) could be seen as a justification for placentophagy in our species. However, we should avoid the conclusion that eating placenta is an innate human behaviour.

Exploring placentophagy is important since all land mammals eat the placenta. If eating the placenta has never been instinctive among our ancestors, this would be another common point with sea mammals, including cetaceans and seals. Interestingly, from this regards, camels are the exceptions among land mammals: they do not eat the placenta. Camels have another particularity among land mammals: like Homo sapiens and sea mammals they have kidneys with medullary pyramids (cf. the chapter by Marcel Francis Williams about marine adaptations in human kidneys). Since camels consume highly salty plants and drink the water of salty ponds, and since, from obvious reasons, sea mammals also have easy access to hypertonic salty substances, one can suggest that placentophagy might be correlated with the urgent need in specific nutrients, particularly minerals, in the post partum period. It is as if placentophagy and non-pyramidal renal medullas were features shared by mammals that do not have access to hypertonic salty substances after parturition. Such correlations should inspire further research that would take into account the concept of sodium pump across the trophoblast membrane and the specific composition in electrolytes of the trophoblast cytoplasm. Can camels from the desert help us to accept our waterside origins?

Summary

All aspects of midwifery and obstetric practices, including the purely technical ones, can inspire questions related to the Waterside Hypotheses. For example, even discussions about the technique of caesarean section offer opportunities to consider intriguing human particularities. How best to open the layer of subcutaneous fat—scalpel or fingers? This discussion is specific to human surgery, since land primates do not have a layer of fat attached to their skin. Once more we mention a common point between Homo sapiens and sea mammals.

By referring to the obstetrical implications of the Waterside Hypotheses we have realised at which point the study of pregnancy and childbirth is a fruitful springboard to understand human nature. It is noticeable that in many languages words related to birth have the same root as the word nature.

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