Turning point in our understanding of the human condition

Michel Odent

Abstract: This is a chapter of Michel Odent's latest book, *The birth of Homo, the marine chimpanzee* (*La naissance d'Homo, le chimpanzé marin*), which is to published at the same time in English and in French by Pinter and Martin, London, October, 2017. It is published here through with permission from the author and publisher.

JOPPPAH is deeply grateful to Michel Odent for this opportunity to share with our readers this "preview."

Author's note: Some parts of this chapter are not vital to understanding the essential points. This is why they are written in small letters in parentheses. However they can satisfy the curiosity of readers familiar with the language of biochemists.

Editor's note: The references are in European style. We were asked by the author and publisher not to change anything in this chapter since it is part of an upcoming publication. Also, the formatting (headings and such) are a bit different from our standard and some words retain European spelling.

Keywords: human development, vernix caseosa, placentophagy, aquatic ape hypothesis

Since the current crisis in the history of planet Earth is related to human activities, our first step will be to focus on the countless particularities of Homo in the framework of mammal species. For each particularity, even among the most mysterious ones, multiple interpretations have been suggested in terms of evolutionary advantages and adaptation to different environments. Today, we just need to follow one simple rule to introduce a unifying theoretical framework. This rule is to a great extent inspired by advances in physiological sciences: when a trait is mysterious, because apparently specifically human, we must look at probable common points with mammals adapted to the sea.

A gigantic and highly developed brain

The main trait that makes human beings different from the other mammals is the enormous brain mass in relation to the size of the body,

Michel Odent, MD, is Director of the Primal Health Research Center in London. He is the author of the first articles about the initiation of breastfeeding during the first hour after birth. Free access to the Primal Health Research Data Bank is provided at www.primalhealthresearch.org. Email for Dr. Odent is modent@aol.com

which is usually evaluated in terms of "encephalisation quotient." Even compared with the other members of the chimpanzee family, from which we probably separated about six million years ago, and although the genetic difference between humans and chimps is less than 2%, our encephalisation quotient is mysteriously three times higher. If we follow the general rule regarding specifically human traits, we realise that the encephalisation quotient of bottlenose dolphins is roughly twice as high as the quotient of the common chimpanzees and the bonobos. As a general rule, mammals adapted to the sea have a higher encephalisation quotient than their cousins on the land.

Another mysterious aspect of human nature is the association of a gigantic and complex brain with an enzymatic system that is not very effective at making a molecule of fatty acid commonly called DHA. This molecule, essential to feed the brain, is abundant and preformed in the sea food chain only. This suggests that humans are programmed to have this molecule included in their diet. In practice, this means access to seafood. Let us recall that 50 per cent of the molecules of fatty acids that are incorporated into the developing brain are represented by DHA. (Land food can easily provide the parent molecule of the omega 3 family [only 18 carbons and 3 double bonds]. To make DHA [22 carbons and 6 double bonds] the enzymatic system must elongate and desaturate the parent molecule). In general, the study of enzymatic systems is an effective way to analyse the main characteristics of animal species. From that perspective Homo appears as a member of the chimpanzee family adapted to the coast.

We can also learn about human nature by focusing on the most common nutritional deficiency. All over the world, human beings have difficulties to satisfy their need in iodine, except if they have regular access to the seafood chain. It is an important issue, since having an enormous highly developed brain implies daily iodine requirements. Iodine is a "brain selective nutrient" because of its essential role in thyroid hormone production, which, in turn, is needed for normal brain development. Iodine is scarce on the earth's surface because over hundreds of millions of years it has been washed away by rain and glaciation and transported from the terrestrial crust to the sea. Seawater contains 10- to 200-fold higher quantities of iodine than freshwater.[1] In the sea, algal phytoplankton, the basis of the marine food chain, acts a biological accumulator of iodine.

It is notable that iodine is the only nutrient for which governments legislate supplementation, so that iodination of table salt is mandatory (the iodine of sea salt disappears during the process of desiccation in salt marshes). In spite of such widespread legislation and many public health strategies (such as dripping iodine in the water of Chinese irrigation ditches), iodine deficiency remains a common nutritional deficiency at a planetary scale. It is the leading cause of preventable intellectual

disabilities. It is difficult for humans to obtain sufficient iodine by consuming a diet lacking in seafood. We must add that some common practices amplify this tendency. Let us mention the milk of cows fed with rapeseed meals: such diets have an iodine antagonist effect.[2]

These issues are particularly serious when considering the increased needs during pregnancy and lactation. It is significant that, according to ATA (American Thyroid Association), women should take a daily supplement (150 µg) of iodine before conception, and during pregnancy and lactation. According to a British study, a daily supplement of iodine when the mother was pregnant is associated with a 1.22 average increased IQ in childhood.[3]

In general, public health organisations are obliged to establish strategies to satisfy such basic universal human nutritional needs that are suggestive of adaptation to the coast.[4,5]

When mentioning the quasi universal needs in supplements of iodine in populations that do not consume sea food on a regular basis, one cannot help thinking of the tendency to constantly enlarge the reasons to take daily small doses of aspirin to keep healthy. It is a long story since "aspirin," in the form of leaves from the willow tree, has been used for thousands of years. There is even evidence that tens of thousands years ago, Neanderthals living in El Sidron cave, in Northern Spain, were consuming leaves of poplar trees, also a source of "aspirin."[6] We have reached a time when nearly all people over 50 are advised to routinely add aspirin to their diet. There is also a tendency to enlarge the indications during pregnancy, at such a point that questions have been raised about the possible beneficial effects of routine prescription of aspirin in all pregnancies (!)[7] One of the main modes of action of aspirin has been revealed in 1971 by John Robert Vane, following the discovery of "prostaglandins" as local hormones produced in the body.[8] It is its ability to suppress the production of "eicosanoids" (prostaglandins and related compounds) by a mechanism of enzyme inactivation. Aspirin tends to correct the widespread current dietary imbalance, characterised by a comparative excess of fatty acids of the omega 6 family. (The final effect of this dietary imbalance is an excess of synthesis of the family of eicosanoid derived from arachidonic acid, a 20-carbon omega 6 fatty acid with 4 double bonds. These "eicosanoids" are, in particular, pro-inflammatory and, by facilitating platelet aggregation, are clotting agents).

The important point is that the production of the eicosanoids derived from the omega 6 family is minimised by regular consumption of sea food, rich in long chain fatty acids of the omega 3 family (EPA and DHA). (There is a mechanism of enzymatic competition. EPA gives rise to eicosanoids that often have lower biological potency than those produced from arachidonic acid, and EPA and DHA give rise to anti-inflammatory and inflammation resolving agents).

The widespread beneficial effects of aspirin might be considered another sign suggestive of the importance of seafood in human nutrition. It is highly significant that daily consumption of aspirin has no detectable preventive effects in the particular case of Japan, a country with a high seafood consumption.[9]

It is probable that, in the near future, references to sea mammals will throw light on the particularities of other human metabolic pathways. (This might be the case of the "sialic acid family," which includes derivatives of the sugar neuraminic acid. It has been demonstrated that the human brain has significantly more sialic acid than the brain of other mammals. It is not mysterious if we refer to the comparative studies - at SeaWorld San Diego - of the urines of humans, orcas, and dolphins.[10])

Two intriguing particularities of human births.[11]

It is commonplace to claim that only the skin of human newborn babies is covered by *vernix caseosa* (literally *cheesy varnish*), a greasy white substance secreted by the sebaceous glands during life in the womb. In many cultures the vernix was denied any role and routinely wiped away. Once more, to interpret this mysterious human characteristic, we must look at probable common points with mammals adapted to the sea.

Don Bowen, a marine biologist from Nova Scotia, Canada, 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. 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 that 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, including squalene, provide a hydrophobic barrier. Vernix is so rich in squalene that a measure of its concentration in amniotic fluid had been suggested as a test to detect the effects of postmaturity.[12] It is noticeable that squalene is more abundant in the aquatic animal kingdom than among other animals.

By combining these perspectives we suggest that *vernix caseosa* might be interpreted as a transitory protection against immersion in salty hypertonic water. We should at least remember that *vernix caseosa* is a common point between *Homo* and seals, while it is unknown among land mammals.

It is also considered intriguing that, apparently, eating the placenta has never been instinctive in our species. If "placentophagy" had been a common behaviour at any time in the history of humanity, we should find

hints at this behaviour in myths, legends, and reports from preliterate and preagricultural 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 their 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 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 never eat the placenta. Let us take this opportunity to mention that camels have another particularity among land mammals: like Homo and sea mammals they have kidneys with multiple "pyramids."[13] Since camels consume highly salty plants and drink the water of salty ponds after giving birth, and since sea mammals also have easy access to hypertonic salty substances, one can suggest that placentophagy and special kidney structures might be correlated with the urgent need in specific nutrients, particularly minerals, in the period following birth. It is as if placentophagy and the usual kidney structures were features shared by mammals that do not have access to hypertonic salty substances after giving birth. Can camels from the desert help us to understand our common points with sea mammals?

Countless other intriguing human features

Many other intriguing human features have been considered by the pioneers of the so-called "aquatic ape hypothesis." Several of them were included in the historical lecture Sir Alister Hardy delivered in March 1960 at a conference organized by the British Sub Aquatic Club in Brighton.[14] Elaine Morgan looked at these features in detail and completed them in her books,[15,16,17] and also in the events she organized (she invited me to participate in a conference of the British Association for the Advancement of Sciences in Southampton in 1992, and in a study day in San Francisco in 1994). The books by the nutritionists Michael Crawford[18] and Stephane Cunnane[19], and also the recent collective book

"Was Man more aquatic in the past?" were other important steps in the history of the theory.

The point is not to analyze in detail each intriguing human characteristic, but to give a list of them in order to reinforce the general interpretative rule we are using. None of these features has the power to support the theory, but bringing all of them together may introduce the final word. Meanwhile, we'll keep in mind another simple rule: when two species are genetically close to each other, most morphological and behavioural differences are usually explained by an adaptation to different environments; conversely, animals that are not genetically related can have many common points if they are adapted to the same environment. For example, New World vultures and Old World vultures look so similar that they have been confused by zoologists. In fact, in the age of genetics, we now know that the American birds are genetically related to storks, while the Old World birds are related to hawks.

-Nakedness is certainly one of the most striking human traits: it is shared with aquatic mammals in general, and also with land mammals such as elephants and rhinos, that are in fact very aquatic and need mud to protect their naked skin.

-A layer of fat under the skin is another feature shared with sea mammals. It may be the equivalent of the blubber, the layer of vascularized fat tissue found under the skin of all cetaceans (whales, dolphins, and porpoises), all seals, and all sea cows.

- The general shape of our body and the upright stance are compatible with life on the coast: it is easier to keep vertical when moving in shallow water. Human babies, for example, can stay erect and walk in water before being able to walk on dry land. Let us recall the point of view of Sir Alister Hardy, "It seems to me likely that Man learned to stand erect first in the water and then, as his balance improved, he found he became better equipped for standing up on the shore when he came out."

-Body temperature control through the loss of sweat has often been considered to be a biological blunder. It is a costly mechanism, depleting the system of large amount of water, sodium, and other essential elements. New interpretations become possible if we think of the human being as a primate adapted to environments where water and minerals are available without restriction.

-A prominent nose is a feature shared with the proboscis monkey, which looks very human. It lives in the coastal wetlands of Borneo and is an excellent distance swimmer. It uses swimming to escape the cloud leopard.

- Still in the area of the upper respiratory tract, our larynx is low, which gives us the choice to breathe with our nose or our mouth. Sea lions and dugongs are also characterized by a low larynx.

- The human vagina, like the vagina of sea mammals, is long and oblique, and is protected by a hymen.

- Some similarities between human beings and sea mammals are bizarre and apparently uninterpretable. However it is worth mentioning them. Menopause, and prolonged life after reproduction is considered a specifically human feature.[20] However, if we follow the general rule and look at sea mammals, we learn that female killer whales and short-finned pilot whales spend two-third of their lives not birthing any offspring.[21,22] Female killer whales typically start reproducing at age 15, and stop in their 30s and 40s. Yet they can live to be more than 90. The point is that, although these particularities of sea mammals are documented, they are never taken into account in the countless theories about human menopause.

-The differences between human hands and those of the other members of the chimpanzee family are also intriguing. The main difference is a triangle of skin between thumb and forefinger. This triangle of skin, which looks similar to the webbing of a duck's feet, is compatible with adaptation to water. The same kind of observation can be made regarding our feet: the big toe is joined to the others in man, but is separated in chimpanzees.

This leads me to mention one of the most common congenital abnormalities (or particularities) human beings can have, namely webbing between the second and third toes. This is highly significant because a congenital abnormality that takes the form of adding a feature usually means that the feature had a reason for being there during the evolutionary process.

A cultural blindness challenged by genetics.

For hundreds of years, the countless philosophers, scholars, and scientists who pronounced on human nature did so without seeing that man has many characteristics suggestive of an adaptation to the seashore. How to interpret such a cultural blindness?

We'll focus on the particular case of experts in human evolution. Until recently, fossil hunters were the only ones with authority to propose theories on human origins. Today there are many ways to evaluate the narrow limits of their perspective:

-We must first realize that 20 000 years ago, due to the volume of ice on land, sea level was still approximately 130 meters lower than when the

Neolithic revolution started, about 10 000 years ago. This implies that if most human beings were living along the coasts during the last glacial period, which occurred from 110 000 to 10 000 years ago, only the fossils of the minority of humans who were living inland will ever be found.

-Only hard parts of the body, such as the teeth, skull, jaw, and limb bones can be preserved and found in fossils. In addition, fossils are often distorted by earth movements during their long burial. As many adaptive characteristics concern the soft tissues only, it is impossible, for example, to distinguish the fossils of a tiger from the fossils of a lion.

- When human fossils are found, it means first that the geological conditions are absolutely exceptional. A fossil discovery belongs to the realm of improbability. First, to become fossilized, human remains must survive the normal process of decay that returns flesh and bone to dust and ashes. Then comes the next highly unlikely event: just as the bone is exposed, but before it can be eroded, a skilled paleontologist must just happen along, precisely at that point. The British science writer, Tim Radford, has concisely clarified what we need to understand, "The surprise is not that there are not more fossil remains; the surprise is that there are any at all." The French geologist, Jacques Varet, who has a good knowledge of East Africa, enumerated all the geological conditions that have to occur together so that a hominid fossil has even a tiny chance of being detected one day. East Africa is so exceptional from a geological point of view that it is not surprising that fossils of hominids living 2 or 3 million years ago were found there.[23] But we have to be cautious before suggesting that the emergence of humanity occurred in this part of the world.

It is in such a context that geneticists are gradually becoming crucial authoritative experts in human evolution, able to challenge the dominant assumptions and theories. From this perspective, it appears today that it is mostly by starting from coastal bases that our ancestors have colonized the whole planet. This is more and more obvious when considering the colonization of the Pacific Rim in general, and the American continents in particular. The genetic perspective, completed with what we know today about the low sea levels during the last ice age and the very ancient techniques of canoeing, offers a new perspective to evaluate the special relationship between Homo and the sea.

The canoes of Neanderthal and Sapiens

It appears today that one of the cradles of human civilization has been the prehistorical lowlands of the Southeast Asian peninsula, that our ancestors have probably reached about 50 000 years ago. This area, commonly called the "Sundaland," was above sea level during the last ice

age. It was twice the size of India, and included what we now call Indo-China, Malaysia, and Indonesia. From there, some of our ancestors migrated towards the South, reaching the ancient continent of Sahul (which is now divided into Australian mainland, New Guinea and Tasmania) about 40 000 years ago. Others migrated towards the North, reaching the Japanese Archipelago also about 40 000 years ago.

Our understanding of the migrations towards the American continents is reaching radically new steps during the second decade of the 21st century.

Until recently, according to theories based on archeological data, the ancestors of the indigenous cultures of the American continents had appeared in what is now New Mexico, where they developed the "Clovis culture." They were supposed to have reached the North American continent through an ice free corridor that extended from Alaska to Montana. We have recently learned from the Danish geneticist, Eske Willerslev, and his team that life came to ice-free Canadian corridor too late to sustain this theory. Studies of plant and animal genetic material indicate that the passageway became habitable nearly 1000 years after the formation of the Clovis culture.[24] Today there is suddenly an accumulation of reasons to favor the theory of a coastal migration route. This is an unexpected opportunity to consider the marine aspect of human beings. The use of canoes is probable.

There are several other reasons to reshape our way of thinking regarding the earliest inhabitants of the Americas. According to radiocarbon dating, human beings were living at least 14 800 years BC in Monte Verde, on the Chilean Pacific coast…about 13 000 kilometers from Alaska![25] Furthermore, genetic studies have demonstrated that some Amazonian Americans descend partly from a Native American founding population that carried ancestry more closely related to indigenous Australians, New Guineans and Andaman Islanders than to any present-day Eurasians or Native Americans.[26]

In the current scientific context, a human migration towards the coasts of South America via the Southern part of the Pacific Ocean is plausible, and even probable. We must keep in mind that 20 000 years ago, when the sea levels were more than 100 meters lower than today, there were countless islands between Polynesia and the Chilean coast. Some of them still exist: Pitcairn islands, Easter Island, Sala y Gomez, Desventurados Islands, San Felex, San Ambroso, Alejandro Selkirk, and Robinson Crusoe, in particular. We must also keep in mind that canoeing was a widespread prehistoric human activity. This only fact is a sign of the deep rooted relationship between Homo and the sea. Nobody knows when our ancestors started to make canoes in the Pacific area, but it is probable that hominids even older than Neanderthal were already sea

farers. One million-year old stone tools have been found on the Indonesian island of Flores, suggesting that probably primitive *Homo erectus* had crossed the sea (Nature, DOI: 10.1038/nature 08844).

Anyway, there is evidence that the Neanderthal variety of Homo could reach Mediterranean islands by canoeing.[27,28,29] Neanderthals lived around the Mediterranean from 300 000 years ago. Their distinctive "Mousterian" stone tools are found on the Greek mainland and, intriguingly, have also been found on the Greek islands of Lefkada, Kefalonia, and Kefalonia. According to George Ferentinos, from the University of Patras, Greece, the sea would have been at least 180 metres deep when Neanderthals were in the region (Journal of Archaeological Science, DOI: 10.1016/j.jas.2012.01.032). Let us add that, in 2008, Thomas Strasser, from Providence College in Rhode Island, found similar stone tools on Crete, which he says are at least 130 000 years old. Crete has been an island for some 5 million years and is 40 kilometres from its closest neighbor. There is food for thought in the comments by Thomas Strasser, "Early hominids may have used the seas as a highway, rather than seeing them as a barrier."

This parenthesis about Neanderthals can help us to accept the concept of migration through the South Pacific Ocean. We must also take into account how important a part was played by birds in the guidance of early navigators in uncharted seas.[30] It is significant that the Rapa Nui name for Sala y Gomez island means "Bird's islet on the way to Hiva." Even in historical times, explorers were still guided by birds. Vincento Pinzon, the Spanish navigator who sailed with Christopher Columbus on their first voyage to the New World, was quoted as saying: "Those birds know their business".

Last bomb: A 130 000-year-old archaeological site has been found in southern California![31]

The story started with the discovery of fossils of mastodons. Before knowing more, we must oscillate between curiosity and skepticism… Let us keep in mind that, in the near future, the detection of human genetic material in sediments will be probably be possible, when fossils (bones, teeth, etc.) are not available.[32]

Know thyself

After combining the physiological perspective, the genetic perspective, and what we now know about the routes our ancestors probably followed to colonize the whole planet, it seems difficult to go on ignoring that Homo has the characteristics of a member of the chimpanzee family adapted to the land-sea interface. As for those who still need other perspectives, I suggest they observe toddlers in paddling pools and they meditate on the

effects of the advent of paid holidays, a phenomenon that suddenly appeared during the twentieth century: from that time on, millions of human beings concentrate on beaches and spend their time watching the waves. Many other bizarre aspects of human behavior can inspire new interpretations. For example, we may be surprised by the current tendency to confuse "natural childbirth" and "water-birth," while seals go on giving birth on the dry land.

To interpret the persisting blindness that make it difficult to accept an essential aspect of human nature, we must analyze the bases of our ways of thinking since the advent of agriculture, animal husbandry, and other aspects of the domination of nature. While the five continents have been colonized originally by human beings living by the sea, the Neolithic revolution started among human groups that had migrated inside the continents and were obliged to adapt to inland life. It started in places as far apart as the "Fertile Crescent," Southwest Asia, China, the Carpathian Basin in Europe, Ethiopian highlands, the Nile river valley, the Andes in South America, the Mexican highlands, and also the highlands of Papua New Guinea. All these places are situated at a certain distance from the sea.

Today, at a time when the domination of nature has reached extreme limits, it is urgent to reconsider our strategies for survival. The prerequisite is to reach a new step in our understanding of human basic needs. The aphorism "know thyself" must now be interpreted as an incitement to explore Homo from new perspectives.

References:

1-Venturi S, Venturi M. Iodine, PUFAs and Iodolipids in Health and Diseases: Evolutionary perspective. In: Human Evolution. Angelo Pontecorboli Editore Firenze. 2014:29: 185-205

2-Schone F, Sporl K, Leiterer M. Iodine in the feed of cows and in the milk with a view to the consumer's iodine supply. J Trace Elem Med Biol. 2017 Jan;39:202-209. doi: 10.1016/j.jtemb.2016.10.004. Epub 2016 Oct 11.

3-Monahan M, Boelaert K, Jolly K, et al. Costs and benefits of iodine supplementation for pregnant women in a mildly to moderately iodine-deficient population: a modelling analysis. Lancet Diabetes Endocrinol 2015 Aug 7. pii: S2213-8587(15)00212-0. doi: 10.1016/S2213-8587(15)00212-0. [Epub ahead of print]

4-Guess K, Malek L, Anderson A, et al. Knowledge and practices regarding iodine supplementation: A national survey of healthcare providers. Women Birth 2016 Sep 2. pii: S1871-5192(16)30094-4. doi: 10.1016/j.wombi.2016.08.007. [Epub ahead of print]

5-Zygmund A, Lewinski A. Iodine prophylaxis in pregnant women in Poland - where we are? (update 2015). Thyroid research 2015 Dec 8;8:17. doi: 10.1186/s13044-015-0029-z. eCollection 2015.

6- Weyrich LS, Duchene S, et al. Neanderthal behaviour, diet, and disease inferred from ancient DNA in dental calculus. Nature 2017 Mar 8. doi: 10.1038/nature21674. [Epub ahead of print]

7-Mone F, Mulcahy C, McParland P, McAuliffe FM. Should we recommend universal aspirin for all pregnant women? Am J Obstet Gynecol 2016 Sep 19. pii: S0002-9378(16)30804-3. doi: 10.1016/j.ajog.2016.09.086. [Epub ahead of print]

8-Vane, John Robert. "Inhibition of prostaglandin synthesis as a mechanism of action for aspirin-like drugs". Nature: New Biology 1971; 231 (25): 232–5

9-Ikeda Y, Shimada K, Teramoto T, et al. Low-dose aspirin for primary prevention of cardiovascular events in Japanese patients 60 years or older with atherosclerotic risk factors: a randomized clinical trial. JAMA 2014 Dec 17;312(23):2510-20. doi: 10.1001/jama.2014.15690.

10-http://www.vin.com/apputil/content/defaultadv1.aspx?pId=11331&meta=Generic&id =4848030&print=1 1/1

11- Michel Odent. Obstetrical implications of the aquatic ape hypothesis In: Was Man more aquatic in the past? Marc Verhaegen, Algis Kuliukas, Mario Vaneeechoutte ed. Chapter 9. Bentham Science 2009.

12- Jenkins DT, Wysocki SJ, Davies DM. Amniotic fluid squalene: a useful test in prolonged pregnancy. Aust N Z J Obstet Gynaecol.1982 Aug;22(3):135-7

13- Marcel Francis Williams. Marine adaptations in human kidneys. In: Was Man more aquatic in the past? Marc Verhaegen, Algis Kuliukas, Mario Vaneeechoutte ed. Chapter 8. Bentham Science 2009.

14- Alister Hardy. Was man more aquatic in the past? New Scientist 1960; 7: 642-5.

15- Elaine Morgan. The Descent of woman. Souvenir Press. London 1972.

16- Elaine Morgan. The Aquatic ape. Souvenir Press. London 1982.

17- Elaine Morgan. The Scars of evolution. Souvenir Press. London 1990.

18- Crawford MA, Marsh D. The Driving force. William Heinemann. London 1989.

19- Stephen Cunnane. Survival of the fattest. World Scientific Publishing. Singapore 2005

20-Alberts SC, Altmann J, et al. Reproductive aging patterns in primates reveal that humans are distinct. Proc Natl Acad Sci USA. 2013 Aug 13;110(33):13440-5. doi: 10.1073/pnas.1311857110. Epub 2013 Jul 29.

21-Croft DP, Brent LJ, et al. The evolution of prolonged life after reproduction. Trends Ecol Evol. 2015 Jul;30(7):407-16. doi: 10.1016/j.tree.2015.04.011. Epub 2015 May 14.

22- Brent, L. J. N., Franks, D. W., Foster, E. A., Balcomb, K. E., Cant, M. A., and Croft, D. P. (2015). Ecological knowledge, leadership, and the evolution of menopause in killer whales. *Curr. Biol.* 25, 746–750. doi: 10.1016/j.cub.2015.01.037

23- Jessica Johnson, Michel Odent. We are all water babies. Dragon's world. London 1994.

24- Pedersen MW, Ruter A, Schweger C, et al. Postglacial viability and colonization in North America's ice-free corridor. Nature September 2016;537: 45-49.

25- Collins M, Dillehay T. Early cultural evidence from Monte Verde in Chile. Nature 1988; 332: 150-152.
26- Skoglund P, Mallick S, et al. Genetic evidence for two founding populations of the Americas. Nature 2015 July 21 .doi: 10.1038/nature14895
27-Yirka, Bob (1 March 2012).Evidence suggests Neanderthals took to boats before modern humans. phys.org. Retrieved 5 May 2016.
28-Marshall, Michael (29 February 2012).Neanderthals were very ancient mariners New Scientist. Retrieved 5 May 2016.
29-Charles Q. (15 November 2012). Ancient Mariners: did Neanderthals sail to Mediterranean islands? LiveScience. Retrieved 5 May 2016.
30- James Hornell. The Role of Birds in Early Navigation. Antiquity September 1946; 20 (70): 142-149. DOI: http://dx.doi.org/ 10.1017/S0003598X0001953031-
31-Holen SR, Deméré TA, Fisher DC, et al. A 130,000-year-old archaeological site in southern California, USA. Nature April 2017; 544: 479-483. doi:10.1038/nature22065
32- Sion , Hopfe C, Weib CL. Neandertal and Denisovan DNA from Pleistocene sediments. Science 27 Apr 2017: DOI: 10.1126/science.aam9695