

SHORT REPORT



## Is the duration of human pregnancy decreasing? A vision of Darwinian medicine

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### ABSTRACT

Why do actual females have a 9-months-pregnancy? Here, we hypothesize that the pregnancies of prehuman species were longer than currently (10 or 11 months), and that anatomical and metabolic changes, by increasing the *in-utero* size of the fetal brain, selected groups with premature delivery, low-calcified and/or not welded cranial vault bones (permitting deformation during the expulsion), until reaching a current pregnancy duration of 9 months.

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The birth of a child after 9 months of gestation is a weakness for the human species: too immature, it has no independence, and can survive only with the support of the community (starting with his mother). This characteristic (“altriciality”) refers to species in which the offspring are born at an early developmental stage, which does not only apply to humans [1].

In human evolution, a marked increase in brain volume occurred during the early use of fire for cooking in 500,000 BC. (i.e. *Homo erectus*.) [2]. From an energetic points of view, cooking contributes to energy being gained by the consumer by three mechanisms: increased digestibility of starch and proteins, reduced costs of digestion for cooked versus raw meat (at the benefit of the individual’s physiology), and reduced energetic costs of detoxification and defense against pathogens [3,4]. Having become much more digestible and available for the pregnant woman and her fetus, protein and lipid resources benefited fetuses whose cerebral (and *a fortiori* cranial) volume was all the more important [5]. Thus, only females with a sufficiently large pelvis (allowing the delivery of these children with relatively bigger heads) were selected during the evolutionary processes [6]. But perhaps also those who were intended to give birth prematurely, relatively to past pregnancies? According to

this hypothesis, what now seems normal for a current brain volume at 9 months (head circumference of almost 50 cm) is perhaps an adaptive aberration for the human species (from prehuman species), that is to say, a persistence of an archaic adaptation which allowed the survival of the species, in a vision of Darwinian anatomy [7]. As a consequence of such variations in maternal nutrition [8], it is likely that prehumans had longer pregnancies: 10 months, perhaps even 11 months, with relatively less head circumference, and perhaps less dependence on others at birth.

The dietary and energy gain linked to the domestication of fire and its use for cooking could also accelerate the maturation of the fetal lungs at the same time so that these immature babies would not die of respiratory failure. A process of genetic selection of individuals whose surfactant proteins and glycerophospholipids were secreted earlier or in greater quantity, maybe stimulated by accelerated glucocorticoids and thyroid hormones, could also occur [9–11].

The voluminous human brain is accompanied by a big head which, in the newborn, hardly passes the pelvic canal. If we apply a genetic model of gestational duration and preterm birth [12], it has probably resulted in a selection of human generations in which the cranial bones of unborn babies are not welded:

thus, a relative deformation of the head could facilitate the passage.

From an evolutionary and obstetrical point of view, the birth canal of humans is mainly constrained by the tradeoff between two pregnancy-related functions: a narrow pelvis is disadvantageous for childbirth but offers a better support for the weight exerted by the viscera and the large human fetus during the long gestation period [13].

Paleo-anthropologists have shown that the evolution of rotational birth, usually associated with encephalization, may have occurred in two stages: the first appeared with the origin of the Australopithecus with their platypelloid pelvis adapted for bipedalism and their broad-shouldered neonates; the second which resulted in the modern mechanism of rotational birth may be associated with increasing brain size in the genus *Homo* [14]. It is even possible that the beginning of this phenomenon had to start with the first prehumans, recovery-parturition conflict, or 5 or 6 million years before Australopithecus. It is also questionable whether the differences in staggering dates of dental eruption (in Kenyapithecus, Ramapithecus, Sivapithecus), considered as clinical signs of prolongation or delay of puberty [15], could participate in the same demonstration.

Living birth would only be possible if the development was slowed down *in-utero*, or if the child went out prematurely. If the archaic *Homo* babies were born at the same stage as their chimpanzee cousins, their head would have been too large to pass the pelvic canal. As a result, they are born with a skull and brain still unfinished, surprisingly immature compared to other animal species (primates). But *Homo sapiens* has made this weakness a force: this immature brain will finish developing outside the maternal womb, being bathed by the sociability of the clan. Hence, this impressive growth of the human line: larger and better-connected brain structures.

Recently, it has been shown that the skull (and the brain) almost systematically undergo axial and transverse deformation at the time of the passage of the pelvi-genital sector in natural (vaginal) delivery [16]. Another selection was, therefore, probably setup: that of individuals with low calcification/ossification of the bones of the skull vault for which a strong deformability was required to allow an aerodynamic “sugarloaf” transformation necessary for the fast and nontraumatic exit from the pelvis.

This is how the human species was able to conquer the world. At what price? Lives of lost women and babies. Only prehuman premature babies could be the

source of our current lineage. The smartest is not necessarily the biggest.

### Ethical approval

This article does not contain any studies with human participants or animals performed by any of the authors. Informed consent statement is not applicable.

### Disclosure statement

No potential conflict of interest was reported by the author(s).

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