Chapter Five The Helpless Baby

Primates

The Primates have evolved under the same basic conditions and constraints as all the other species of plants and animals. They appear to have developed from a specie of ground-dwelling shrew, which adapted to an arboreal environment.

The terrestrial plants, which form the basis of such environments, tend to have structures which optimise the utilisation of light, air and water. As a result, their structures are mainly horizontal in character. However the competition for the basic constituents of growth have also led to the development of vertical structures, which provide support for a hierarchy of horizontal growths.

The various specie of animals which adapt to these arboreal environments are influenced by the relative abundance of the horizontal and vertical structures. As a result, the majority of these animals are adapted to the horizontal structures, which comprise the major food resource of the tropical forests.

Horizontal and Vertical Adaptation

These animals normally walk, or perch, on the branches of the trees, where they feed upon fruit, nuts, leaves or insects. Threfore they usually have long tails to help them to maintain their balance. In addition, as many branches tend to be fairly thin, and prone to breakage, the horizontally-adapted species tend to be relatively small, light and agile.

However, where species of plants have no branches, or have to grow to great heights before they can develop their branches, their animal consumers have to adapt to a vertical structure. These animals have to be able to climb up and down the trunks of the trees, in complete safety, and with the minimum expenditure of energy.

As a result, vertically-adapted specie all tend to have relatively short and powerful hind-limbs, which enable them to climb a vertical stem with maximum efficiency. In addition, their forelimbs are relatively long, and specifically adapted to hang on to a vertical structure. Furthermore, to maximise their power-to-weight ratio, they all tend to have relatively short bodies and tails. However, because the vertical structures tend to be thick and strong, such animals are usually larger and heavier than the horizontally-adapted species.

This physiological division in respect of horizontal arid vertical adaptations is reflected in various classes of animals. For example, in the Marsupial Class, the Opossum is adapted to the horizontal structures. As a result, it is a relatively small, light and agile animal, with a long tail. In addition, it has relatively long hind-limbs which are adapted for jumping. By contrast, the Koala is a relatively large, tail less animal, with short hind-limbs and long forelimbs.

In the Mammalian Class, the Bears are examples of an essentially quadrupedal specie which have adapted to a vertical arboreal environment. As a result, they are virtually tail less, with short hind-limbs and a short body.

Also in the Mammalian Class, the Pandas provide an excellent example of divergent adaption. Thus the Red Panda is a relatively small, arboreal quadruped with a long tail. It also has long hind-limbs adapted for jumping. By contrast, the Giant Panda has adapted to Bamboo plants, (which are devoid of side branches). As a result, it has a bear-like structure, being relatively heavy with short, powerful hind-limbs - and virtually no tail. (Note: despite their names, these two specie are not closely related).

Among the primates, similar variations occur in the Pro simians, with the majority of specie being represented by the small, light jumping creatures, which have long tails. By contrast, the vertically-adapted specie are relatively large, slow moving, and tail-less creatures.

Altitudinal-Latitudianal Evolution

The evolution of the primate specie appears to have followed the normal pattern of altitudinal and latitudinal adaptations. Thus the initial speciation evolved in the equatorial regions.

In the global warm phases, the equatorial regions expanded with a consequential increase in speciation, and individual abundance. However, the increased speciation resulted in the scattering of individual plant foods of each specie, within the equatorial regions.

As a result, the plant-specific primates had to increase their mobility between the scattered food sources, or adapt to a single individual tree.

By contrast, during the global cool phases, the equatorial regions contracted - with consequential extinctions of individuals and specie. As usual, the individuals of the surviving plant specie became more common, which enabled the plant-specific primates to reduce their travelling between the individual food sources.

This pattern of individual and specie variation affected the arboreal primates, and led to specific adaptations which were predicated by the alternating warm and cold phases.

In this regard, the omnivores were relatively unaffected by the global temperature changes. Their numbers fluctuated, but their organic and behavioural adaptations were essentially related to their predatory activity and diet.

As a consequence, in the global warm phases, the primates which had adapted to specific plant foods (such as leaves, fruit or nuts), would be forced to adapt to the increase in the distribution of their food sources. Therefore these specie evolved into two types, namely: relatively small specie which survived in a single tree, and relatively large specie which developed an improved terrestrial, or arboreal mobility.

Combined

The general process of primate evolution appears to have combined these ecological variations with the horizontal and vertical adaptations. As a result, the primates can be classified in terms of their dietary and structural adaptations.

In this context, there appear to be two kinds of fruit or leaf-eating primates, namely: vertical frugivores, which are vertically-adapted fruit eaters; and horizontal frugivores, which are horizontally-adapted fruit or leaf eaters.

Similarly, there are vertically-adapted and horizontally-adapted omnivores. In addition, there are transitional vertical/horizontal omnivores.

It appears that the primate ancestors were a specie of equatorial shrews. In common with most small mammals, these shrews almost certainly lived underground, and led a nocturnal life.

In a warm period of biospheric evolution, these shrews expanded in abundance, and forced their subordinate variants into higher altitudes. As a result, the marginal specie had to adapt to a transitional omnivorean existence, foraging partly on the ground and partly in trees. They would remain nocturnal, and probably slept in tree hollows during the day.

In the periods of global cooling, these early primates would reverse colonise their predecessor's mainstream habitat, although they would remain transitional omnivores.

In the warm phases of biospheric evolution, the process of plant speciation and consequential individual scarcity would force the early primates to specialise.

Complementary

As a result, the species which adapted to single trees would tend to evolve into horizontal frugivores, or complementary vertical omnivores. In this regard, the former would develop into small, light and agile jumpers, with long tails; while the latter would be relatively large, slow moving, tail-less animals. It is proposed that these creatures would become the ancestors of the Pro simians.

At the margins of the equatorial regions, the plant species would be reduced in number, although the individual plants of each specie would be relatively common. In some areas, individual trees of the same specie would clump together.

As a result, the horizontal frugivores would be able to jump from tree to tree, and these primates would colonise the equatorial periphery. In time, some of these primates would adapt to the vertical structures, to become vertical frugivores. It is proposed that these primates would become the ancestors of the Lemurs.

The subordinate variants of these specie would be forced to adapt to a complementary position within the peripheral environments. Thus they would become transitional omnivores, feeding partly on the ground and partly in the trees.

Nocturnal

These primates evolved in the Mesozoic era, when the most predominant terrestrial animals were dinosaurs. As the large dinosaurs required a degree of solar heating to maximise their predatory activity, they only hunted during the daylight hours. As a result, these early primates remained nocturnal.

In the period of global cooling at the end of the Mesozoic era, most of the large terrestrial dinodaurs became extinct. As a result, the subordinate variant primates were able to switch to a diurnal existence, which would complement the nocturnal habits of the existing primates.

However, the adaption to a diurnal niche would require physiological changes to survive the increased temperatures involved. For example, the subordinate variant individuals would have to increase their surface-to-volume ratio to dissipate the extra heat. This could be most easily achieved by the development of a relatively long, thick tail. It is proposed that the resulting diurnal, equatorial specie became the ancestors of the Marmosets and Monkeys.

In the next warm phase of biospheric evolution, the ancestors of the Marmosets and Monkeys specialised in much the same way as their primate predecessors. Thus the subordinate specie colonised all the equatorial niches, with the ancestors of the Marmosets adapting to individual trees. However, the ancestors of the Monkeys were forced out to the periphery, where they became vertical and horizontal frugivores.

Old World Monkeys

The Monkeys' subordinate variants would be forced out of the equatorial regions, where they would become subtropical, transitional omnivores. When Africa separated from South America, due to continental drift, it appears that all the subtropical regions were in Africa. As a result, it is proposed that these transitional omnivores became the ancestors of the Old World Monkeys.

The mating requirements of the early primates were probably met by the same basic systems as are employed by other nocturnal mammals. Nocturnal specie all tend to use a mixture of scents and vocal stimuli, as their olfactory and aural sensory systems are most highly developed. However, the adaption to a diurnal existence would lead to improved vision, so there could be an advantage in the development of visual stimuli.

In this context, the ancestors of the Marmosets and Monkeys would be unable to see each other in their dense tropical rain forest. As a result, these specie would concentrate on their vocal stimuli.

However, in the relatively open subtropical habitats of Africa, the transitional omnivores would spend more time on the ground, where they would be subject to terrestrial predation. In this regard, as a vocal stimuli would tend to attract predators, the development of a visual stimuli would be advantageous to the specie. As the Monkey’s eyes had become adapted to colour delineation, a visual stimuli would be most effective if it involved a colour change in a conspicuous part of the specie's anatomy.

It is proposed that this is why the Old World monkeys have patches on their bottoms, which change colour when the individuals start their breeding cycle. Furthermore, to ensure that the visual stimuli is not obscured, these monkeys have relatively slim, light tails.

The general process of marginal colonisation continued in Africa, until the development of a transitional omnivore in the temperate altitudes and latitudes. In the mountain regions, this subordinate variant developed a stocky physique with powerful hind-limbs to enable it to traverse a mountainous habitat. It is proposed that this specie became the ancestor of the Baboons, Drills, and Macaques.

In a period of global cooling about 35 million years B.P. (before present), both the subtropical and temperate subordinate variants reverse colonised the optimum habitats; and became widespread throughout the equatorial regions. Thereafter, the process of specialist adaptations recommenced.

Ape Ancestors

In this regard, the relatively small, subtropical variants colonised the habitats of the horizontal frugivores and omnivores. However, the larger and more powerfully built temperate variants were better adapted to colonise the vertical frugivore and omnivore habitats. As a result, a temperate subordinate variant adapted to the vertical structure, and became tail less, with short hind-limbs and long forelimbs. It is proposed that this specie became the ancestor of the Apes.

When this vertically-adapted specie spread out to the periphery of the equatorial regions, the trees became clumped in the usual way. As a result, the specie could move from tree to tree. However, because it had no tail, the specie could not walk on the top of the branches, and jump from branch to branch. Instead, it was forced to swing underneath the branches, and develop the ability to brachiate. This adaption to swinging enabled the specie to extend its habitat to the side branches of the trees.

The ancestors of the Apes tended to specialise in the same manner as the other primates. Thus, the ancestors of the Gibbon adapted to a single tree, feeding from both the vertical and horizontal structures. By contrast, the ancestors of the Orang-utan developed a much wider territory, by brachiating from tree to tree.

About 10 million years B.P., the continents of Africa and Asia merged due to tectonic plate movement. This allowed the Asian Ape specie to colonise the 'Ape' niches in Africa. However, as the incoming Asian apes were food specific, this process took a long time.

By 6 million years B.P., the sea levels had risen to such an extent that the whole of the African Rift Valley had become an inland sea. The hilly nature of the terrain produced a lot of islands near the inland coasts. This created an advantage for the incoming Asian ape as the African monkeys were unwilling to swim or wade out to these islands.

Existing Asian Apes are Bipedal on the ground

It was in this island environment that the Asian/African apes developed a high degree of bipedalism. It should be noted that the existing Asian apes (i.e. The Gibbon and the Orang-utan) are either wholly or partially bipedal on the ground. In this context, the Gibbon is always bipedal when it is on the ground; while the Orang-utan is sometimes bipedal and sometimes quadrupedal.

The nearest analogy to the island environment of the Asian/African ape, is to be found in South East Asia, where the Crab Eating Macaque lives in Mangrove Swamps. This specie of monkey has developed a bipedal ability which in some ways is similar to that of the Human specie. In this context, when the Crab Eating Macaque walks on its hind legs it places one foot directly in front of the other, and walks in a very human-like way. By contrast Gorillas and Chimpazees tend to sway from side to side when they walk on their hind legs.

The reason the Crab Eating Macaque has developed a degree of bipedalism, is that when the nursing female has to move from one mangrove clump to another, she has to carry her infant in her arms. Normally, monkeys carry their infants under their belly. But if the Crab Eating Macaque female did this, her infant would drown. So the female has learnt to walk on the sea bed, carrying her baby in her arms.

It is generally believed that the Asian/African ape specie also developed bipedalism in their island environment in the same way as the Crab Eating Macaque - and for the same reason. There is fossil evidence which clearly shows that some of these creatures developed a high degree of bipedalism, while others were less well adapted. Probably those who lived on the outermost islands developed the greatest bipedal capability, while those closest to the coast would be less well developed.

Sea Levels Drop

About 5 million years B.P., the inland sea levels started to drop. As they did so, the Rift Valley gradually emerged and became available to specie who were living in the inland coastal regions. This naturally benefited the Asian/African apes, and their numbers expanded as a result. It is proposed that these Asian/African apes became the Autralopithecines.

By 4 million years B.P., the inland sea levels had dropped so much that the only large stretches of water left in the Rift Valley were those of Lake Uganda and Lake Victoria. The old island habitat merged into the African Mainland, and the territory of the Australopithecines was invaded by African monkeys.

Initially, the most bipedal of the Australopithecines could hold their own against the monkeys. This was because they could walk in a straight line to the food sources, whereas the monkeys had to take more circuitous routes from branch to branch. If danger threatened, the good bipedalists could climb up the nearest trees.

However, not all Australopithecines were good bipedalists. The bad bipedalists had relatively long arms and short legs, and could not walk as fast as the good bipedalists.

As a result, they were heading for extinction. In such a situation, they had to adapt, or move, or die.

The key to their survival was speed on the ground.

Ancestor of the Bonobo

It is proposed that one of these bad bipedal Australopithecine adopted the method of locomotion known as knuckle-walking. The individual concerned would have to have been very small and light, otherwise it would have injured its knuckles as it used them to walk quadrupedally on the ground. The knuckle-walking would enable the individual to outpace the good bipedalists, and so reach the food sources before they did.

Eventually, the numbers of the knuckle-walking Australopithecines increased and the specie adapted biologically so that its knuckles and finger bones were tough enough to enable long distance travel without injury. It is proposed that this small, light equatorial specie of Australopithecine became the ancestor of the Bonobo.

At this point, as the ancestral Bonobos would take all the mid canopy food, some of the good bipedalists were forced to concentrate on the ground level vegetation. Other good bipedalists would be forced to move into the semi-equatorial forests to find their food.

Ancestors of the Gorilla

In due course, larger and heavier variants of the Bonobo developed, and these creatures were forced by their size and weight to source their food at ground level. It is proposed that these variants became the ancestors of the Gorilla. As the Gorillas were knuckle-walkers, they could outpace the ground level good bipedalists, and the latter became extinct.

Ancestors of the Chimpanzee

After these developments, a further variant of the Bonobo evolved. These creatures were bigger than the Bonobo, but smaller that the Gorilla. As such, they could not compete with either of these specie, so they were forced into the semi-equatorial forests.

Here they had to compete with the good bipedalists. However, as these variants of the Bonobo were knuckle-walkers, they could easily outpace the good bipedalists on the ground. So they survived and prospered. It is proposed that this intermediate specie of knuckle-walker became the ancestor of the Chimpanzee.

This explains the present distribution of the African Apes. The idea that the African apes are descended from the Australopithecines is not yet mainstream, but there is very good evidence for it. One of the indications of such an ancestry, is the way in which the African Ape specie behave when they are angry. In this context, the African apes invariably stand up and pace around on their hind legs. As angry behaviour is generally considered more primitive behaviour, this implies that the African apes have a bipedal ancestry.

Standing Upright

The good bipedalists were forced to look for food outside the semi-equatorial forests. Now it was their turn to face extinction. They had to move, adapt, or die.

The only available territory was in the subtropical environment. The subtropical regions are fiercely hot during the day, and cold at night. It is so hot during the day that most mammals in these regions feed and hunt only at night. There are very few trees, and relatively little food. This was hardly suitable for an ape specie.

But the Australopithecine good bipedalists had one significant advantage over the indigenous subtropical mammals. This was their bipedalism. It was not the ability to walk on their hind legs which conferred the advantage, but rather the ability to stand upright. This meant that only their head and shoulders were exposed to the sun in the daytime - so they didn't heat up as much as the quadrupedal mammals in the region.

The good bipedalists were able to walk around in the daytime, when all other mammals had to shelter from the sun to avoid heat-stroke. This meant that the bipedal Australopithecines could be the first on the scene to scavenge the carcasses of animals killed during the previous night.

In addition, they could see where the nocturnal burrowing for underground tubers had taken place. As a result, they were able to survive in this harsh environment.

In addition, no knuckle-walking Ape could follow them into the subtropical region, as the Ape's quadrupedal habit would prevent them from competing with the good bipedalists during the heat of the day.

Heat Dissipation

However, the good bipedalists were not perfectly adapted to their new environment. They also suffered from excess body heat during the day. As a result, the specie gradually adapted physiologically to improve its ability to dissipate excess body heat.

To this end, the most effective way it could improve its heat dissipation was by developing thin spindly legs, thin spindly arms, and a slim light body structure. However, their head would have to remain the same size, as they would still need the same size of brain to find their food, and the same teeth and jaw combination to eat their food.

This adaptation to the subtropical environment led to a change in the specie's 'head-to-body' ratio.

It should be noted that this type of physiological development is normally impossible for mammal specie. The limiting factor here is the female pelvic canal, through which mammal babies must pass when they are born. In this context, an examination of mammal specie will show a remarkable correlation between the size of the head and the size of the body, in individuals of all specie (except humans).

For example, a small head/large body configuration creates feeding, nutritional and neuro-physiological problems. This can be illustrated by imagining a mammal which had the body of an elephant, and the head of a mouse!

By contrast, a large head/small body configuration creates severe embryonic problems -- which normally results in either the death of the female, or the infant, or both.

Any adult mammal, which has either a relatively large head for its body: or a relatively small body for its head, will transmit these characteristics to its progeny. As a result, its baby would inherit the large head/small body configuration.

In order to be born, the baby must pass through its mother's pelvic canal. However, the pelvic canal's size is proportional in size to the baby's body. As a result, if the baby's head is relatively large, it will not pass through the pelvic canal -- and normally (in the wild), both mother and baby will die.

However, when a specie develops a change in its 'head-to-body-ratio' the rate of physiological change is so gradual that a persistent adaptive demand would only affect a relatively few individuals per generation.

There is only one evolutionary solution to the large head/small body problem. In cases where there is a persistent adaptive demand leading to regular birthing problems, natural selection will effect a change in the rate of growth of the baby's head in its foetal stage.

In such a case, the foetus's body will grow at the normal rate, but its head will grow at a marginally slower rate. Consequently, at the time of birth, the baby's head is smaller than it would normally be -- and the baby can be born. The baby’s head then completes its foetal stage outside the womb.

The genetic variations which produce this phenomena are not unusual. They effect the genes which control the timing of the embryonic and foetal development process. These determine the growth rates of the animal's organs, as well as its overall rate of growth. The variations are usually very marginal, and are the cause of the differences in each individual's size, weight, metabolism and maturity rate etc. As a result, no two animals of any specie are exactly the same.

The head-to-body ratio of mammals is affected by this process all the time. As a result, there are marginal differences in the relative sizes of individual's heads and bodies in all mammal specie. However, in all specie except the human specie, the variation in the head-to-body ratio is always very slight. For a very good reason.

Baby’s brain is not fully developed

Thus any mammal baby, which has been affected by these genetic variations, can be born with minimal birthing problems. However, because its head has grown at a slower than normal rate within the womb, it means that at the time of birth the head has not completed its foetal growth stage. This means that the baby's brain is not fully developed. As a result, such babies are incapable of any independent behaviour in the period immediately after their birth.

This is due to the nature of the nervous system, and the process of its embryonic and foetal development. To put it very simply, the nervous system may be considered to exhibit two kinds of physiological behaviour.

Firstly, there is the 'automatic' nervous system, which includes the autonomic nervous system that controls the blood vessels, gut and digestive system;and the somatic muscle system, which moves the body of the mammal. This, together with the endocrine system of hormones, controls all the automatic regulation of the body, and initiates the reflex actions of the muscles. This system is linked with the inner parts of the brain, such as the hypothalamus, mid brain and cerebellum.

Secondly, there is the cortex and neocortex of the brain, which together with associated somatic motor systems determine the cognitive and manipulative behaviour of the mammal.

All parts of the nervous system are very much inter linked, but they grow at different speeds in the embryonic and foetal stages of growth. Generally, the automatic nervous system grows first, while the cortex and its associated somatic systems grow last.

When mammal babies are born, the automatic nervous system initiates the breathing, and regulates all the vital reflex actions. The cortex then initiates the baby's cognitive development - starting with the vital task of learning to find the mother's mammary glands.

Under normal circumstances, the cortex will have completed its foetal growth stage by the time the baby is born, so a baby mammal can make its way, on its own initiative, to the mother's mammary glands. Even young mice and kittens, which are born blind, find their way independently - guided by the heat radiated from their mother's abdomen.

Immature brain

However, the newborn baby of any mammal which has a large head/small body configuration, has an immature brain. The automatic nervous system is complete, but the cortex is not.

As a result, such a baby can suckle (which is a reflex action) , but it cannot actually move itself to its mother' s mammary glands. Thus, unless the mother actively brings the baby to her mammary glands - and guides the baby's head, so that the baby's mouth is close to the nipple, the baby will die.

The inability of most mammal mothers to do this, is one of the reasons why the large head/small body configuration is not common among mammals.

Another serious problem, for mammals with the large head/small body configuration, concerns the transportation of the baby. Thus, even if the mother can arrange the suckling of the baby, the latter will not be able to move its limbs -- other than by reflex action.

To move independently: to crawl, to climb, to reach out, and to hang on to an adult, requires independent control and manipulation of limbs -- in a cognitive, purposeful way. Reflex actions are not sufficient.

Mammal specie with prehensile hands or feet, can pick up their babies, but most such specie are either quadrupeds, or specie which pursue totally arboreal lives. In this regard, both the former and the latter require the use of all their limbs during adult locomotion. As a result, these mammals require that their babies actively hang on to their mothers, while the latter move from feeding place to feeding place.

Thus, it appears that the only mammal specie which could evolve a large head/small body configuration are the Bonobo, Gorilla, Chimpanzee and Human species. Only the latter has actually done so.

In this context, it should be noted that if an animal evolves a certain characteristic in response to a particular ecological niche, then no other animal will evolve such a characteristic -- unless they develop in almost identical organic and environmental circumstances.

Thus, although both Gorillas and Chimpanzees could probably rear completely helpless babies, they would not need to unless they occupied an ecological niche which required a change in their head-to-body ratio. It appears that the only ecological niches which have this requirement, have been occupied by the ancestors of the Human specie since the last Australopithecine radiation.

In fact, primatological research has shown that if Chimpanzees give birth to stillborn babies, they will try to suckle such babies. Furthermore, they will carry such infants in their arms -- walking bipedally to do so.

Here, the strength of the maternal instinct overcomes the inhibitions of the female, in respect of bipedal locomotion. When such female chimpanzees conclude their infants are dead, they discard them, and return to knuckle-walking as a means of terrestrial locomotion.

The Helpless Baby

It might be thought that the easiest, and most obvious way for nature to deal with the large head/small body problem, would be to enlarge the pelvic canal of the female.

In fact, this is precisely what happens to most mammals, whenever a specie increases its overall size. However, as the pelvic canal gets larger, so does the whole pelvis - which leads to a bigger body. As a result, the head-to-body ratio stays the same.

In the subtropical altitudes of equatorial Africa, the ancestral humans (hominids) could evolve a change in their head-to-body ratio, in one of three ways. Thus: they could evolve a bigger head, maintaining a normal body size; or they could evolve a smaller body, maintaining a normal head size; or they could evolve a bigger head and smaller body at the same time.

It is proposed that initially, they evolved according to the second alternative. This was due to an adaption for heat dissipation. They needed a slimmer, slighter body with slim slight legs and arms to allow them to survive the heat of the daylight hours.

Helpless babies

The resultant change in the head-to-body ratio would then lead to the birth of helpless babies. In the two or three weeks following their birth, such babies would remain helpless -- until the foetal growth stage of their heads (and brains) had been completed. Thereafter, such babies would behave like a typical, African ape infant.

It should be noted that the degree of helplessness would not change. Every increase in the head-to-body ratio leads to a corresponding increase in the length of the period of the baby's helplessness.

This is because the embryonic and foetal growth rate of the brain, within the womb, is slowed down more and more. Hence it takes proportionately longer for the head to complete its foetal growth stage outside the womb - after the birth of the infant.

It should also be noted that the gross increase in the length of the head's embryonic and foetal growth stage (i.e., both inside and outside the womb), leads to a proportional increase in the length of all the other stages in the individual's life. For example, if the gross embryonic and foetal stage of the head is increased by 15% (i.e. one month), the infantile stage would also increase by 15% (i.e. four and a half months).

The increase in the period of the hominid babies' helplessness, would be disadvantageous to the mothers; but maternal instinct, coupled with evolutionary selection, would place a premium on improved child-rearing abilities.

In this respect, the survival of the specie would depend upon the physiological and behavioural adaptations of the nursing females.

Consequential Physiological Adaptations

The reduction in the foetal growth rate of the hominid infants brain would be matched by consequential physiological adaptations to its body. In this context, it should be noted that the differential rates of growth of different parts of the body in the embryonic and foetal stages, reflect the general ability of organisms to vary their growth rates at different times in their life span.

For example, many species of mammals develop various secondary sexual characteristics during their adolescent stage of growth. Thus the growth of male beards, and female breasts, in the human specie, show how organic control of growth mechanisms can be adjusted to increase, or decrease -- to meet the needs of the individual.

In this context, it is proposed that the present delay in the development of the human baby's bone, muscle, and myelin sheaths, are consequential evolutionary adaptations to the physiological requirements of the helpless baby.

As previously proposed, the reduction in the growth rate of the baby's cortex and neocortex, initiated the baby's helplessness. This in turn, would encourage specific reductions in the growth rates of the baby's limb bones, and their associated muscle and nervous systems. In every generation, there would be individuals whose somatic muscle and nervous growth, would be premature or immature -- vis a vis the brain. However, the majority of individuals would have sufficient correlation in their respective brain and somatic muscle system growth rates to survive.