Evolution of Human Encephalization: Three Factors Of Developmental Timing

Evolution involving Homo sapiens (humans) has become a topic that has been frequently analyzed. It has also been frequently compared to evolutions of other mammals when discussing how the various changes impacts one's life. Encephalization in particular has been discussed when examining the changes the humans species has gone through. Encephalization is the evolution behind the size of the brain in various species relative to their body size. Encephalization in humans sets them apart from other mammals because of their larger than normal brain size compared to other mammals and the factors behind them.

Human encephalization have had relations with the brain allometry theory and the three factors of developmental timing. Looking deeper into the three factors of developmental timing, these three factors help in distinguishing the brain size of humans compared to other mammals, such as chimpanzees. The first factor is about the humans brain growth and brain allometry. Postnatal brain growth does not play a magnified role in humans. To compare this with other mammals, less than 30% of brain growth and brain allometry can account for a human brain more than 3 times the size of a chimpanzee brain. The second factor is that over the past years, brain allometry seems to have evolved in humans more compared to other mammals.

Taking chimpanzees as an example of mammals, humans and chimpanzees do not share a common brain growth allometry. This could be due to the prediction of a chimpanzee's brain size at birth is usually twice the observed size value. The final factor is that postnatal development is very important in human encephalization because of the reduction in human body growth rates, in comparison to the body growth rates of apes.

The evolution of human encephalization was also influenced by the changes of developmental timing. In terms of the changes in developmental timing, human encephalization can be understood as a combination of three components: slowed down postnatal body growth, a derived brain growth allometry, and extended brain growth.

Continuing on with comparing the human brain size, the size of the human brain is about three times to size of our closest relatives such as the chimpanzees who have maintained around the same brain size. Reasons behind the variation in brain size have focused on things we benefit with such as dealing with challenges and cooperation is social groups. The metabolic energy that is transferred to the brain also has an effect on the brain size. For adult chimpanzees, it's round 13% while for adult humans, it's around 20%. The smaller the mammals is, the less amount of metabolic energy is transferred to the brain which results in a smaller brain size. Since humans have a large brain compared to most mammals, this results in humans investing more time energy into producing every single off-spring. Because of this, human infants are relatively large and have considerably higher fat content.

Focusing on the features of the brain that assisted with the evolution of human brains, there are a few principles that took part in it. The environment humans are around in itself determines the shape and size of the brain compared to other mammals such as apes. Environmental factors are focused around physical environments (food availability, climate) and social environments

(parental care, group size). Although research is still being conducted on figuring out why this is the case, comparative neuroimaging studies have identified the unique features of a human brain. These studies help explain why there's such a huge difference between the size of a human brain and the size of a chimpanzee brain.

Encephalization also impacts the endocranial shape of the brain. Comparing data between Neandertals (subspecies of archaic humans) and modern humans, both represent two distinct and independent evolutionary paths. This means that both groups of species may have followed completely different paths of developing their brain despite having similar evolutionary mechanisms.

The evolution of human encephalization has developed through the evolutionary history in various aspects. Human encephalization can be explained through brain allometry, developmental timing, physical and social environments, amounts of metabolic energy being transferred to the brain, and the endocranial shape of the brain. At this moment, more research needs to be conducted on the exact details behind how the evolution of human encephalization has impacted one's tasks in their daily lives in the present compared to centuries ago. Conducting this research could further help the scientific community develop what more evolution for the human brain occur and how it would impact the future of humanity.