

The great genetic leap

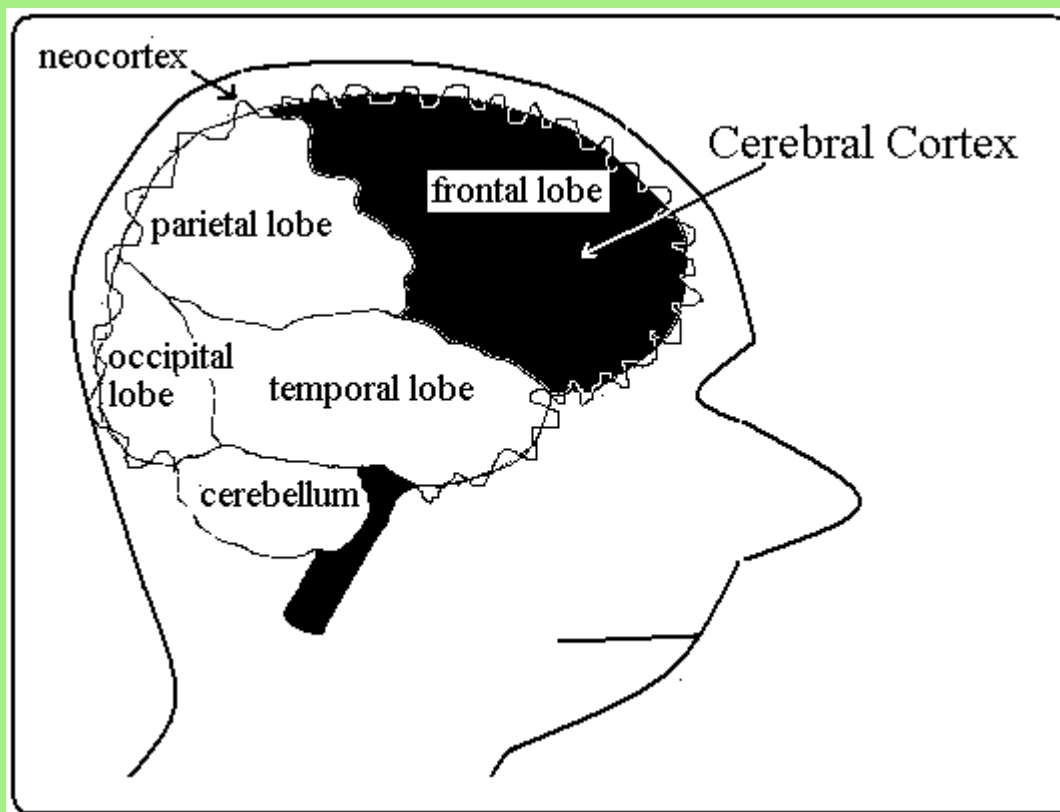
It appears that the factors that make humans develop a brain superior to other animals are getting recognised, says S.ananthanarayanan.

A genetic factor that sets the human brain, during the development of the human embryo, on a rapid, human-specific path of development seems to be responsible for homo sapiens to have sped away, along the evolutionary highway, from his cousins.

Scientists at California, Cornell, Brussels and Lyons have jointly announced in *Nature* this week that they have identified the uniquely human genetic area that expresses during the 7th to 19th weeks of gestation, the crucial time of development of the cerebral cortex, the part of the brain that controls its most sophisticated functions.

Brain structure

The most recent evolutionary development of the brain is the neocortex, which is a part of the brain found only in mammals. The neocortex consists of a layer, some 2-4 mm thick and covering the brain with the legendary 'grey matter'. This is the part of the brain that is involved in functions like sensory perception, generation of motor commands, spatial reasoning, and conscious thought and, in humans, speech and language.



The neocortex, in the case of primates, is folded into grooves and wrinkles which increase its total area. It consists of 6 areas, each concerned with a different set of functions. It is unique to larger animals, although some of the functions are also found expressed in lower animals, which do not have the neocortex. In humans, this part accounts for about 80% of the brain's weight.

It is considered that the accelerated development of this part of the brain signaled the burst of speed which carried humans into the lead – in using tools, manipulating the environment, and later, in speech, abstraction, Shakespeare, Beethoven and Einstein.

Genetic treasure hunt

The nature and evolution of the brain, because of its complexity, has been a 'grey' area in scientific understanding. But with the help of the detailed mapping of the DNA of many species which is now available, scientists were able to compare the genetic structure of humans with their closest evolutionary relation, the chimpanzee, and to identify the places where the two genomes differ. The vast part of the genetic map, which is common, and unchanged since millennia, was scanned for areas that changed since humans parted ways with the chimp. The regions that underwent the greatest and fastest changes were then isolated and ranked. What was found was that the most dramatic 'human accelerated region', or HAR, was in the novel genetic region that is responsible for development of the neocortex, in the human embryo between the 7th and the 19th week of development. Accelerated development of this and other regions have provided a brace of candidate areas of the genome for finding out what is uniquely that in our genetic make-up that makes us human!

The mechanism

Chance substitutions in DNA that first put the neocortex in the fast track provided early primates with such survival advantage, by increased environmental awareness, cognition and reasoning ability, that there was definite positive reinforcement of each change. The spiral was then set up to select more and more changes, to lead to the vastly superior thinking equipment of humans in so short a time. Studies have suggested that our final split from the chimp may have been only 5.4 million years ago.

The dramatic nature of the change in this short time, as compared to the four billion years that life is thought to have existed on earth, has provoked some fanciful notions of how humans actually took that long step to cross the great divide between primates and men and women. The discovery reported this week is the identification of a region in the human genome which has the potential to bring about the rapid change, the factor that we are looking for.
