



## The Deadliest Microbes Turned Apes into Human Beings

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### Background

Human evolution has been traditionally investigated primarily through the analysis of prehistoric bones and tools, an approach that, at best, can offer only a truncated picture of the biological complexity of the evolutionary processes at work. In particular, it cannot offer a window through which to view the subtle evolutionary forces taking place on the molecular level of organisms. The investigation presented here was undertaken to demonstrate a methodology that may help fill gaps in our understanding of molecular mechanisms underlying human evolution by focusing upon the interplay between ecological changes and consequent exposure to novel infectious agents that may have exerted molecular selective pressures influencing the evolution of *Homo* species.

### Methods

The research focused on the assessment of the role of positive molecular ecological selection exerted by infectious agents on different stages of human evolution and on discovering the molecular remnants of this process in modern *Homo sapiens*.

### Results

It is well known that primate evolution proceeded in two distinct stages. The first stage, known as the Tropical Forest stage, covered the period from the appearance of the earliest insect-eating mammals to the wide spread of the earliest apes. The second, known as the Savannah stage of primate evolution, culminated in the appearance of the earliest *Homo* species.

Anthropogenic process radically accelerated during the second stage: whereas the Tropical Forest stage lasted approximately 59.7 million years, the Savannah stage spanned only 5.3 million years. The proprietary descent of

*Homo* species (1,8 my), was approximately 35 times shorter than the evolution of apes, including the acknowledged ape ancestor of Humankind, *Australopithecus* from the earliest mammals. From an evolutionary perspective therefore, it is clear that human evolution was extraordinarily rapid and accompanied by uncompromisingly cruel, highly intense selection pressures.

At the beginning of the Savannah stage (5.3 years ago), human ancestors underwent a forced transition from a herbivorous to a carnivorous diet. The new diet provided superior nutrition, but it also opened up new possibilities for primates exposure to new, life-threatening infectious agents. These new exposures abruptly intensified the molecular forces of natural selection. Absolute majority of vegetarian apes have disappeared being unable to survive at these new conditions. The quantity of selective infectious agents introduced through consumption of foods of animal origin is documented in the history of repeated epidemics, which periodically culled early *Homo* populations and favored the survival of individuals with mutations resulting in enhanced genetic immunity against specific microbes. The mutations were passed down to successive generations. Later human migrations substantially expanded the "circle of infections and immunity," and in turn, influenced the continued evolution of microbial species that came into contact with early *Homo* species. Subsequent genetic admixture of distinct human populations further increased the number of new protective features of human's molecular constitution. Many traces of infectious induction of anthropogenesis are now found in the properties of modern persons.

### Conclusions

This work provides a new perspective upon both the foregoing evolution of *Homo sapiens* and the evolutionary significance of modern epidemics.