

2010

## The Ascent to Man

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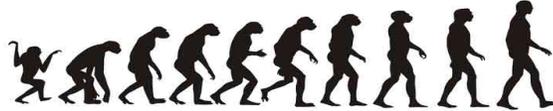
### Recommended Citation

Browne, Lauren, "The Ascent to Man". *The First-Year Papers (2010 - present)* (2010).  
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## The Ascent to Man

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Lauren Browne



It had been a long day at the hospital and I was hungry and exhausted. After a successful heart transplant in the morning and an emergency triple bypass surgery at the end of the day, I was eager to get home. As I changed out of my scrubs the thought of a hot bowl of my favorite tomato and basil soup when I got home brought a smile to my face; I could almost smell and taste it. A nice hot bath afterwards followed by a quiet rest in front of the fireplace would be the perfect ending to a hectic day. But I knew it was just wishful thinking. As I turned the key in the front door, I could hear the elation inside as my three children came running to greet me.

“Mummy, Mummy, Mummy!” all three shouted in unison.

“I want to go to the store and buy the new Barbie!” screamed 6-year old Lilly as she hugged my leg.

“Mummy, can you drive me to Tommy’s house after dinner, he wants to show me his new Nintendo 64?” asked 5-year old Adam.

“Mummy... my tummy weally, weally huurtsss... right here,” cried 4-year old Oliver as he pointed to his chest.

For a few minutes, I almost felt like my day was just starting. When I finally promised a new Barbie to Lilly, negotiated with Adam for a different day to see Tommy’s new game, and rubbed Oliver’s belly, everyone seemed all better and content. After dinner, I went inside to sit on the couch when Oliver came running in and plopped himself down right next to me.

“Mummy, I have a question... where did I come from?” he asked.

Having the two older children who often ambushed me with questions, I felt prepared to answer almost anything.

“Well Sweetie, when two people really love each other...” I had started to say when he quickly interrupted me.

“No, no Mummy!” He shouted, “Andrew already told me that part in school today... I want to know where did people come from? How did we all get here?”

I was surprised by Oliver’s acuteness and quickly tried to reach into my memory bank for the answer that would satisfy his curiosity. I remember having learned about human evolution during my early years in college, but the details of it now seemed to escape me and the best I could do was offer him a lame answer.

“Well Sweetie, if I really knew the exact answer to your question, I’d be a millionaire,” I said, “but I will find out, I promise.”

“Are we going to be rich then?” Oliver wanted to know.

“We’ll be rich with information,” I responded with a smile.

I knew from Oliver’s expression that I had not given him the answer he was looking for and he left the room. That night as I tried to settle down and sleep, I thought some more about Oliver’s question. Sure, I had learned about Darwin’s theory of evolution and had read enough textbooks that explained how we all come from a

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common ancestor. But the more I thought about it, the more I realized that I had no idea of what our human lineage specifically looked like or what environmental factors had contributed to our evolution, but I was determined to find out.

\* \* \*

The next day I got up early, even though it was my day off from work at the hospital, and I decided to go to the library to find the answer to my son's question. As I began to research the topic, I was amazed at how many theories there were regarding our descent from a common ancestor. The information was so extensive that I didn't even know where to begin. As I was trying to sort it all out and understand the fossil pictures and illustrations that were in front of me, the librarian walked over and tapped me on the shoulder.

"Hello there, dear... are you finding what you're looking for?" she asked.

"Well, to tell you the truth," I said, "all this information is a bit overwhelming for me."

In an attempt to clear my confusion, she offered me an invitation to attend a lecture that she felt would be helpful.

"Well, this afternoon Professor Williams, one of the many distinguished professors at Trinity College, will be delivering a lecture about the origin of man on the Trinity campus. I'm sure that if you go you will get a lot out of it. He's also very happy to answer any questions that you may have," she said.

My excitement was hard to contain and I cried, "Absolutely! Thank you so much. I will definitely be there."

\* \* \*

Later that afternoon I walked into the auditorium and grabbed the last seat available in the back row. The room was packed with students and professional researchers. I took off my sweater and began to take notes.

Professor Williams began his lecture with a warm welcome to everyone.

"First of all," he said, "I'd like to thank you all for coming out here today to join me in this great hall while it's 75 degrees outside and sunny. It's a real pleasure and honor to be here on this great campus and in this wonderful community to discuss a very important topic on human origins."

"I'd like to start off with a quote from an alleged Victorian lady upon hearing about Darwin's ideas:

*"Let us hope that what Mr. Darwin says is not true, but if it is true, let us hope that it will not become generally known."*

Professor Williams continued, "Well, fortunately for the progression of science, Darwin's theory has become generally known and it has helped bring us to our current understanding of human origin. As I'm sure most of you are aware, Darwin was an English naturalist who concluded that all species are descendents from a common ancestor, which was the result of a process that's been coined *natural selection*. Although Darwin didn't address the specific lineage of modern human descent, he did address our place in nature, as well as the evolution of traits that make us human. It wasn't until Thomas Henry Huxley published his work in 1863, entitled *Evidence as to Man's Place in Nature*, that it was concluded from this study of comparative anatomy, embryology, and ethology, that humans have a very close evolutionary relationship with the great apes and that humans are not apart from nature, but are rather citizens of the environment (Huxley 1863)."

“The study of human origin is a compilation of many different disciplines,” explained Professor Williams. “Paleontologists, who study fossils to gather information on morphological changes, team up with archaeologists who study material culture, such as stones and tools, to trace the history of behavioral changes. These scientists work in a collaborative effort with geneticists who use proteins and DNA to broaden their understanding of our genealogical history. It is the assembly of each of these disciplines that allows the full picture of human origin to be inferred.”

“We’ve all heard that humans share a relationship with the great apes, but what exactly does this relationship between modern man and great apes look like and how far back in time did humans and great apes share common ancestry?” asked Professor Williams as we all sat mute. “Also, when exactly did these characteristics that define modern humans and distinguish us from the rest of the animal world evolve? What environmental and global shifts caused the changes that occurred on the lineage leading specifically to modern humans?” Professor Williams assured us that he would be answering all these questions today.

“Scientists today recognize that the human species and its key attributes are products of over 3500 million years of evolution that have also given rise to millions of other creatures that now roam this planet (Lambert 1987). But in order to truly understand what we are and who we come from, the entire chain of ancestry that goes beyond apes and monkeys to the earlier animals from which they descended must be considered. This takes us back to about 60 million years ago when our likely human ancestors resembled rodents more than actual people. Some of these ancient mammals began climbing trees because of the intense competition on the ground and the abundance of resources that were in the tree canopies across vast geographic regions in North America, Europe, and Asia (Campbell 1988). It was these ancient prosimians that were our ancestral primates and are likely to have eventually evolved into the present day prosimians, monkeys, apes, and human beings.”

“It wasn’t until the Eocene epoch (about 55-35 million years ago) that mammals beginning to resemble the monkey or ape, started to appear as the overall climate rose in temperature, building a bridge from lower primates to the evolution of higher primates. These higher primates are defined by their enlarged brain size, accurate color vision, forward-facing encased eyes, opposable thumbs, and highly organized social systems. Finally, in the late Miocene epoch around 24-25 million years ago, the existent primates had emerged that would become the ancestors of all the modern species of apes and humans (Tattersall 1993). It was during this period that hominids finally became distinct and were able to achieve their greatest diversity. These ancestral primates would eventually split into two lines dividing the evolution of the apes and the evolution leading to humans and chimpanzees. Another divergence would occur only around 6 million years ago to differentiate the chimpanzees from our direct ancestors, the early hominins.”

“Today there exist two main theories on the evolution and dispersal of our species, both of which are based on fossil evidence and are an effort to provide an explanation for where in the world exactly modern man emerged from. Both theories also try to infer why our modern human species today is the only species of its recent lineage to have survived, despite the fact that we shared the planet with other ‘forms’ of humans some 10-20 thousand years ago. Before I go into greater detail in regards to these two models of human descent,” said Professor Williams, “I’d like to first introduce you to the history of events which have led to our current understanding of our lineage from a common ancestry with the great apes.”

“Throughout the late 1800’s and early 1900’s, it was believed that humans were closely related to African apes based on the reasoning of Darwin and Huxley. All species on our branch are referred to as hominins, or pre-humans leading up to our modern form. Throughout the 1920’s-1960’s, however, the common view shifted back to the idea that humans are much more distantly related to the great apes and that the modern human had existed for a much greater time period, which has also given rise to the evolution of different races. This idea was also believed to have been supported by fossil evidence; the discovery of *Ramapithecus* which was an ape-like species that lived in Eurasia about 15 million years ago appeared to be anatomically related to the hominid lineage, therefore it supported an ancient divergence from the great apes (Simons 1964).”

“It wasn’t until the 1960’s, when it was suggested by the molecular field that evolutionary history could be inferred with the use of a molecular approach by comparing the proteins extracted from different organisms. The evolutionary relationships between those two organisms could then be gathered. By applying this technique to humans and other species today, it showed that we are more like the African apes than the Asian orangutans. This molecular approach has actually provided evidence for our remarkably recent divergence from the African ape dating back only about 5-6 million years ago (Sommer 2008). This basis, however, was only truly supported by the majority of anthropologists when more fossils were gathered, which led to the realization that *Ramapithecus* was, in fact, more like the orangutan than the modern human (Simons 1964).”

“New DNA technology has enabled us to hybridize different genomes of various species to determine their relatedness. From this new technology, we have been able to deduce that humans and chimps are more closely related than either one is to the gorilla with 98.8% of DNA sequences shared between the modern human and the chimp (Yunis 1982). As our technology and fossil findings have progressed, our perspective of man’s place in nature has also evolved. We have shifted from the view of human supremacy above all biotic and abiotic factors, to a more realistic view of our place in nature as an equal member of the ecosystem.”

“A key aspect of human anthropology aims to study how far in time traits of modern man may have evolved. Whether it was intelligence or the ability to walk upright that differentiated our human species from pre-human forms has long been a topic of debate. With the boom in fossil discoveries throughout the mid 1900’s, it became clear that multiple species coexisted on earth at the same time in history. Furthermore, these findings have also been used to piece together the emergence of specific traits that have eventually become part of modern human.”

“From the ordering of characteristics, we can see that the earliest hominins, leading up to the Australopithecines (the genus living in eastern Africa from about 4-1 million years ago) essentially were small-brained creatures with large teeth. This species of early hominins were, however, able to walk and eventually gave rise to more robust and gracile forms of *Paranthropus* and *Homo genus* (Lovejoy 1981). Based on these anatomical findings from fossil evidence, it has become apparent that it was ultimately our mobility and upright position that gave our ancestors the key primary advantage before brain size developed (Kimball 1982).”

“Overall, it was the commonality of locomotion between these early australopithecines that were most unique because they were completely bipedal and so, had to develop much larger shoulder and forearm muscles in order to swing in trees since their feet could no longer grasp tree branches (Anton 2010). But what exactly had to

take place anatomically in order for bipedalism to emerge?” asked Professor Williams. “Well, aside from the evolution of a more platform foot, enlarged joint surfaces, and rearrangement of limb and abdominal muscles, a broader pelvis also had to develop. In addition, a restructuring of the ear bone had to evolve to account for the balance shift of walking upright (Campbell 1988).”

“The advantages of bipedalism were certainly vast since they enabled these early hominins to travel more efficiently for food, to transport their food, to feed in a stationary position, and to better avoid predators. Finally, bipedal walking freed the hands of these early hominins for the creation and regular use of tools. Even Darwin believed that bipedalism was the result of the use of weapons and this, in affect, resulted in smaller jaw and teeth size. He wrote that ‘the free use of arms and hands, partly cause and partly the result of man’s erect position, appears to have led in an indirect manner to other modifications of structure (Darwin 1869).’ As these early humans acquired the habit of using stones, clubs or other weapons, ‘they could use their jaws and teeth less and less. In this case the jaws, together with the teeth, would become reduced in size (Darwin 1869).’ From such evidence, it has become apparent that bipedalism had far reaching implications, not only for the behavioral development of man, but also for the evolution of structural anatomy.”

“To further evaluate our more recent human evolution, it is necessary to study the behavioral distinctions that emerged in our lineage following upright mobility. Through archaeological findings that have provided evidence of the use of tools dating back to 2.5 million years ago, known as Oldowan tools, a story of the evolution of human behavior can be seen as these tools gradually became more sophisticated tools, known as acheulean tools which existed about 1.7 million years ago. The typical Oldowan tools that have been uncovered are simple pebbles or stones carved into spheroid shapes, and are inferred to have been used for hunting purposes (Gibbons 2009). Also dating back to around 45 thousand years ago, we see the very early basis of culture, a defining human characteristic, in ‘painted beads.’”

“But how exactly did we make the transition to modern forms with a much larger cranial capacity?” asked Professor Williams. “Well, just this past March the National Research Council (NRC) published a report stressing the importance of research on whether ‘critical junctures in human evolution and behavioral development may have been affected by the environmental characteristics of the areas where hominids evolved’ (Grant 2010). Through new findings that support a climatic shift to drier weather conditions that occurred around the time that human species began to use stone tools, it is likely that changes in the environment were key in the evolution of man. As the seasonal aridity that plagued the African continent around 7 million years ago increased, our hominoid primate had no other choice but to adapt to life in its expanding open habitat. With great climatic fluctuation that had to be endured with the ice ages, the warming period, the floods and the droughts, it is hypothesized that these oscillating atmospheric conditions required our common ancestor to learn how to quickly adapt, which is likely to have meant that big brains provided an advantage to humans because they had a survival edge in such an unstable and harsh environment (Grant 2010).”

“Also, remember that at this period in time multiple taxonomic groups coexisted. Even after *Homo sapiens* emerged and multiplied, it is now apparent that other species of *Homo* were occupying the vast geographic region. Neanderthals, for example, have been discovered to have coexisted with the modern human species up to around 28 thousand years ago. Only 13 thousand years ago, a much smaller hominin relative named *Homo*

*floresiensis*, often called the hobbit, was around 3 feet tall and also lived along side *Homo erectus* and *Homo sapiens* (Culotta 2007).”

“It is truly remarkable to imagine the small geographic range populated with many various species of humans. Despite all the different related species that coexisted with our modern species, *Homo sapiens* somehow managed to dominate the landscape two millions years ago and out-survive all other human forms. How exactly this remarkable event occurred remains an open question and mystery. For a greater explanation of how such an episode might have occurred, there are two main models used which I mentioned earlier.”

“The first theory, known as the ‘Multiregional Evolution’ is based on the idea that *Homo erectus* dispersed out of Africa and colonized Asia. It was from this dispersed population that *Homo sapiens* emerged through the interbreeding of different hominin groups. Once the emergence of *Homo sapiens* occurred, this species would migrate from one region to another in concert. This hypothesis is supported by fossil evidence that points to gene flow and reproduction, however, the Multiregional hypothesis does require the presence of pre-existing large and interbreeding populations of hominins (Anton 2010). The Multiregional hypothesis is, therefore, largely contradicted by a significant pool of genetic evidence that suggests a very small group of African ancestors are traceable to all worldwide populations.”

“In the second theory, known as “Recent African Displacement,” modern humans originated from a single time and place in the world (Africa), and replaced all other non-modern forms in Europe and Asia including human species such as *Homo erectus* and the Neanderthals. From this theory, it is assumed that all features that characterize the modern human originated from the same place (Stringer 2002).”

“As I said earlier, both of these models of evolution are based on fossil evidence. Through the use of modern genetics, however, an intermediate theory may be supported. When analyzing mitochondrial DNA from people in Asia, Europe and Africa, they all trace back to a single woman, who has become known as “Mitochondrial Eve,” supporting the theory that humans recently originated in Africa and spread out to replace other human species (Anton 2010). When analyzing autosomal DNA, however, we are able to draw lineages that trace *Homo sapiens* to many parts of the world, first dating back to over 2 million years ago, giving credibility to the Multiregional Evolution theory (Stringer 2002).”

“Clearly, multiple parts of the human genome must be studied to provide an illustration of our common descent. To summarize what we have been able to show, there are many nuclear genes and variations that trace to a single African ancestry, yet there do exist exceptions in which the African Replacement model does not fit all DNA data. It is the combination of the two theories that gives rise to the assumption that interbreeding could have occurred between the African modern human and the Asian *Homo erectus*. This explains the existence of portions of *Homo erectus* genes that have filtered into our human gene pool. So, generally, we can deduce that human populations were isolated and tended to speciate, but exchange of some genetic material enabled gene flow between populations. Such a compilation model explains why the majority of our genome shows to have come from Africa, yet there exists portions that reflect a more complex evolutionary history originating from other areas.”

“Regardless of what model is used to illustrate our origins, it is a widespread understanding that our descent has been the result of a step-wise, gradual process of evolving human traits. As our species has spread and has come to populate nearly every

corner of the globe, it is irrefutable that our human characteristics have distinguished us from all other life forms on this planet and, in some ways, we have become ‘masters’ of the globe. Our human species is defined by superb intelligence, politics, culture, and technology that has the tremendous capability to defend and alter our living space by manipulating the ecosystems in which we live. While this is a remarkable advantage, I think that it’s important to be aware of its implications and the potential for it to lead to our own disadvantage. Regardless of how we as a human species ultimately choose to manipulate our surroundings, one thing is for certain – we are the product of a process larger than any man-made practice and we will continue to be subject to this process. As the world around us transforms, whether as a result of our own doings or not, man too will adapt to the change in the continual, constant effort to thrive across each generation of life.”

Professor Williams concluded his lecture by hoping everyone had enjoyed themselves and gained new knowledge. “It certainly has been a real pleasure being here to share what I know with you, and I thank you all for coming. If anyone has any questions, I’ll be here all afternoon to take them.”

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I left the auditorium with a new understanding and clarity. Before listening to Professor Williams’ lecture today, I had never been able to merge together all my findings on human evolution into a logical understanding of our origin.

When I pulled into the parking lot to pick up Oliver from pre-school, I could hardly wait to share my new understanding of our ancestry with him.

“Hi, Sweetie, how was your day at school?” I asked as Oliver slipped into the seat. “What did you learn today?”

He shrugged his shoulders and said, “Nothing.” “But I drew a picture for you... it’s a picture of people,” he exclaimed.

“Wow,” I said, “It’s a masterpiece – I love it!”

As Oliver buckled up I reminded him about his question to me the night before.

“Did you find the answer,” he asked me as his blue eyes lit up.

“I think so,” I said and began to explain.

“Oliver, there’s a lot of evidence out there – proof, you know like in books and pictures, – and there are all these different theories – or ideas – that try to explain how we’ve come into existence – or how we got here.” Oliver listened closely. “But the important thing for us to remember is that we come from a long line of ancestors – like a big family with lots of brothers and sisters, aunts and uncles, grandmas and grandpas. And everyone has contributed with some of its characteristics; it’s like everyone has pitched in with a little bit to get us to look the way we do as humans. The way we look today didn’t just happen over night, Oliver, it took a long, long time and it is to our ancestors that we owe our look to,” I said.

“I get it,” shouted Oliver, “I got my big nose from Grandpa and my blue eyes from Uncle Greg.” Oliver was beaming as if he had just answered the million-dollar Jeopardy question.

No man on earth can say for certain exactly where we come from or what has brought us to our current being and place in time. There is a lot that we don’t know and I believe that there are things that surpass our ability to ever fully comprehend. Nonetheless, the efforts in reaching an understanding of our origin are vital for our prosperity in the future, and for the future prosperity of generations to come.

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