

Speaker's manuscript – Medicine prize 2022

Research on human evolution

The Nobel Prize in Physiology or Medicine

- The Nobel Prize in Physiology or Medicine is one of the five prizes founded by Alfred Nobel and awarded on 10 December every year.
- Before Alfred Nobel died on 10 December, 1896, he wrote in his will that the largest part of his fortune should be placed in a fund. The yearly interest on this fund would pay for a prize given to "those who, during the preceding year, shall have conferred the greatest benefit to humankind."
- The Nobel Prize in Physiology or Medicine is thus awarded to people who have either made a discovery about how organisms work or have helped find a cure for a disease.



The 2022 medicine prize

- Through his pioneering research, Svante Pääbo accomplished something no one thought possible: sequencing the genome of Neanderthals, an extinct relative of present-day humans, or *Homo sapiens*.
- He also made the sensational discovery of a previously unknown type of human, or hominin, which came to be known as Denisova.
- Svante Pääbo has created an entirely new field of research: paleogenomics. His sequencing of the genomes from extinct Neanderthals and Denisovans has given us an entirely new set of tools for understanding the genetic basis for what makes us all uniquely human.



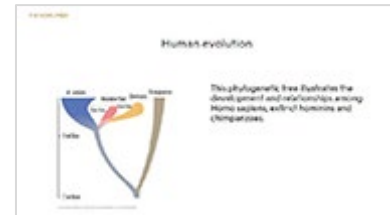
The 2022 medicine laureate

- Svante Pääbo was born in Stockholm in 1955. He is a specialist in evolutionary genetics.
- In 1999, Pääbo founded the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany, where he still works today.
- Since the 1980s, he has been working to develop methods of analysing the DNA of our now-extinct relatives.
- Svante Pääbo's father, Sune Bergström, was also awarded the Nobel Prize in Physiology or Medicine. He was awarded the prize in 1982.
- The term *hominin*, which appears in the prize motivation, refers to humans and all of our closest extinct relatives. However, this group does not include other primates, such as chimpanzees, gorillas and orangutans.



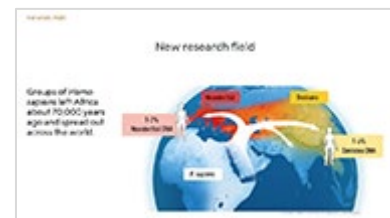
Human evolution

- Chimpanzees are humans' closest living relatives. Our developmental lineage split from that of chimpanzees about seven million years ago.
- Our closest extinct relatives were the Neanderthals.
- In 2008, another human relative was discovered, and it was given the name Denisova. It was discovered when Svante Pääbo studied a bone from the little finger of a human found in the Denisova Cave in Siberia. DNA from the finger bone showed its genetic sequence to be distinct from that of Neanderthals and *Homo sapiens*. Pääbo realised that this was a previously unknown hominin.
- Through his pioneering research, Svante Pääbo has been able to demonstrate the genetic differences between *Homo sapiens* and our closest extinct relatives.



New research field

- Modern humans (*Homo sapiens*) emerged in Africa 300,000 years ago. About 70,000 years ago, groups of *Homo sapiens* migrated from Africa into the Middle East and to the rest of the world beyond.
- When *Homo sapiens* arrived in Europe, Neanderthals were already living there. For tens of thousands of years, *Homo sapiens* and Neanderthals coexisted. When *Homo sapiens* migrated eastward, they also encountered the Denisovans.
- *Homo sapiens* interbred with both Neanderthals and Denisovans, and we still have traces of these hominins in our genes, as shown in the illustration.
- We *Homo sapiens* are unique for our complex culture, innovative capacity, the creation of figurative art and our ability to cross open water and spread throughout all of the inhabitable parts of our planet.
- Neanderthals too lived in groups and had large brains. They also had tools, but they developed them very little over the course of hundreds of thousands of years.
- Why Neanderthals and Denisovans died out about 30,000 years ago is not entirely clear.



Ten thousand-year-old material analysed

- Svante Pääbo has established an entirely new field of research: paleogenomics. His research team has sequenced the genome of our extinct relatives.
- DNA is contained in two different places in our cells: the nucleus and the mitochondria. The DNA of the nucleus contains most of our genetic material, which is called nuclear DNA. The mitochondrial DNA contains a very small proportion of the cell's total genetic information, but there are thousands of copies of it.



- After death, DNA begins to break down and mix with DNA from other organisms, such as bacteria. Thus, in human remains that are thousands of years old, there is very little DNA left to analyse. When researchers handle such remains today, there is also a great risk of their own DNA contaminating the samples. One of the first things Svante Pääbo developed was a refined method for handling and analysing mitochondrial DNA from a 40,000-year-old piece of bone. He then became the first to sequence the genome of our closest known extinct relative.
- He continued to develop and refine the method for sequencing a genome. It was this method he used for sequencing the entire genome in the nuclear DNA of Neanderthals and Denisovans. He thereby succeeded in doing something that everyone around him thought was impossible: identifying the genomic sequence of humans that lived tens of thousands of years ago in spite of the fact that their DNA had broken down over time.
- Comparative DNA analyses have shown that Neanderthals split long ago from the ancestors of today's humans.

For the greatest benefit to humankind

- Humans are curious creatures, and we have always asked questions about our own existence – who we are, where we come from and what it is that makes us human.
- Svante Pääbo's pioneering work has created a foundation for explaining what makes us uniquely human.
- This research contributes to our understanding of human development.



“The last forty thousand years is quite unique in human history, in that we are the only form of humans around.”

- In an interview given in conjunction with the announcement of the 2022 medicine prize, Svante Pääbo talked about his discoveries and his research.

