

## Implications of Palaeogenomics

### Why in news?

The Nobel Prize for Physiology 2022 has been awarded to Svante Paabo, Swedish geneticist, who pioneered the field of palaeogenomics.

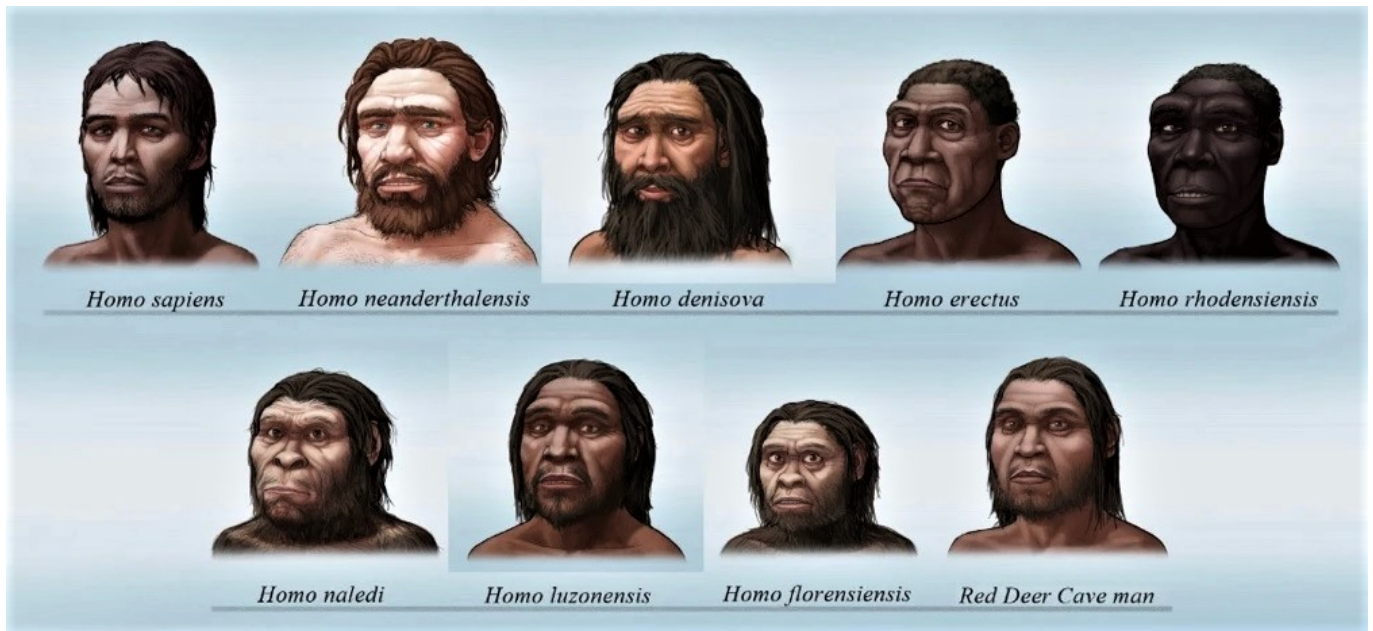
### What is palaeogenomics?

- Palaeogenomics is the study of ancient hominins by extracting their DNA.
- It is the science of reconstructing and analyzing the genomes of organisms that are not alive in the present day.
- **Extracting DNA from fossils**- The challenge with extracting DNA from fossils is that it degrades fairly quickly and there is little usable material.
- The chances of being contaminated by human as well as other bacterial DNA is also higher.

*DNA is concentrated in both the nucleus and mitochondria. While nuclear DNA stores most of the genetic information, the mitochondrial genome is more retrievable.*

### What is the significance of Paabo's work?

- Paabo pioneered the use of DNA to examine questions about the relatedness of various ancient human species.
- He proved that **Neanderthals**, a cousin of the human species that evolved 1,00,000 years before humans, interbred with people.
- A fraction of the Neanderthals' genes (about 1-4%) live on in those of European and Asian ancestry.
- Comparative analyses with the human genome demonstrated that the most recent common ancestor of Neanderthals and Homo sapiens lived around 8,00,000 years ago.
- After analysing a 40,000 year old finger bone from a Siberian cave, he proved that it belonged to a new species of hominin called **Denisova**.
- This was the first time that a new species had been discovered based on DNA analysis and this species too had lived and interbred with humans.



## What are the implications of palaeogenomics?

- **Evolution-** The study of ancient DNA provides a way to test theories of evolution and the relatedness of population groups.
- In 2018, the DNA extracted from skeletons at Haryana's Rakhigarhi showed that the Harappan denizens lacked ancestry from Central Asians/ Iranian farmers, stirring a debate on 'Aryan migration.'
- It will aid in understanding a lot more about the intimate connection between genetics, environments, survival fitness and life itself.
- **Diseases-** Researchers have analysed dental fossils to obtain information on dental infections.
- Genome-wide association studies have found that Neanderthal DNA may be linked with autoimmune diseases, type 2 diabetes, and prostate cancer.
- Paabo linked an increased risk of severe respiratory failure following COVID-19 with a set of genes that are inherited from Neanderthals.
- These genes are present in 50% of South Asians and 16% of Europeans.

## References

1. <https://www.thehindu.com/sci-tech/science/does-palaeogenomics-explain-our-origins/article65985857.ece?homepage=true>
2. <https://www.nhm.ac.uk/discover/who-were-the-neanderthals.html>
3. <https://www.sciencefocus.com/science/denisovans/>

## Quick facts

### Neanderthals (*Homo neanderthalensis*)

- They are believed to be the closest extinct human relatives.

- **Time period-** About 400,000-40,000 years ago
- **Region-** Europe and southwestern to central Asia
- **Appearance-** Large nose, strong double-arched brow ridge, relatively short and stocky bodies
- **Intelligence-** The brain size of late Neanderthals is larger than the modern average, but in proportion to their body size.
- **Art-** They were skilled tool makers and developed an innovative stone technology called the **Levallois technique** (making pre-shaped stone cores that could be finessed into a finished tool at a later time).
- There are evidences of Palaeolithic artwork in the caves of Spain made by Neanderthals with hand stencils and geometric shapes.
- They also made jewellery.

## Denisovans

- Denisovans are an extinct relation to modern humans.
- The Denisovans are the first ancient hominin species to be revealed by genes alone, not by fossil classification.
- **Time period-** About 500,000 to 30,000 years ago
- **Region-** Siberia and East Asia
- They were the contemporaries of Neanderthals and even Homo sapiens (who first emerged about 300,000 years ago).
- Denisovans lived interbred with the ancestors of some modern humans.

