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.

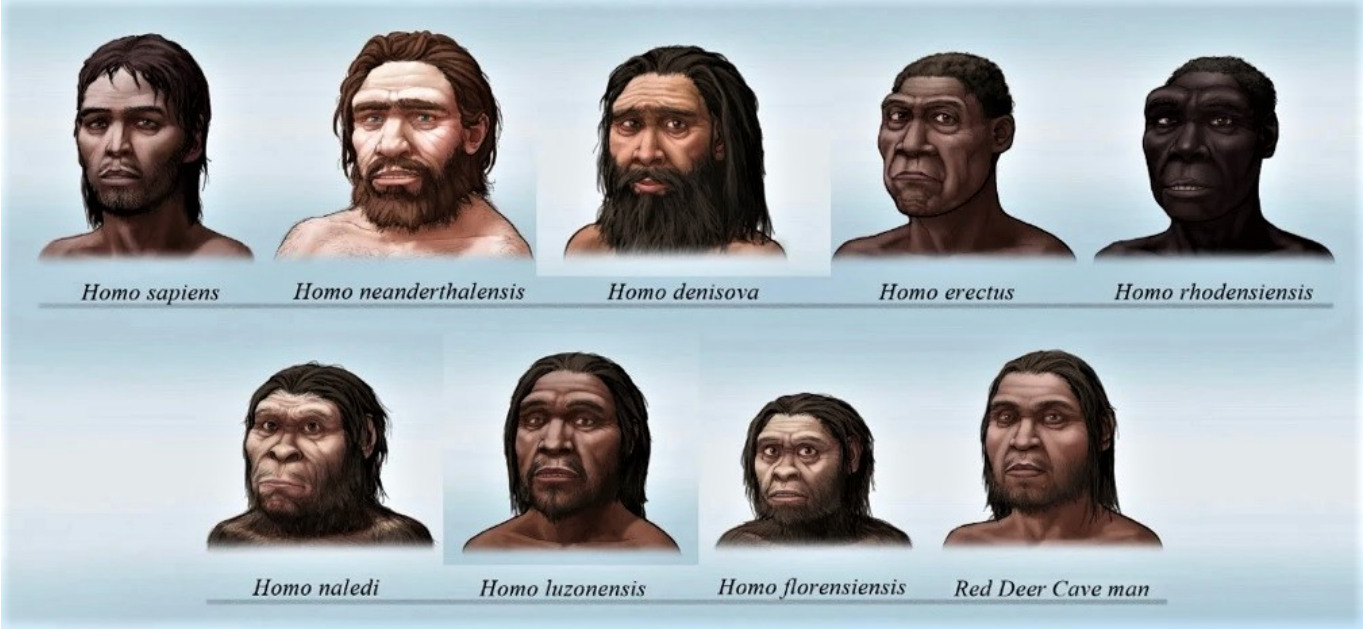
What is palaeogenomics?

- 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.