



Nobel Prize 2022 in Medicine/ Physiology

For Prelims: Nobel Prize for Physiology or Medicine, Paleogenomics, Neanderthals, Denisova

For Mains: Nobel Prize for Physiology or Medicine, Paleogenomics, Neanderthals, Denisova, scientific Innovations & Discoveries

Why in News?

Recently, the 2022 **Nobel Prize for Physiology or Medicine** has been awarded to **Swedish geneticist Svante Pääbo** for his **research in the field of genomes of extinct hominins and human evolution.**

- In **2021**, the honour went to two United States-based scientists, **David Julius** and **Ardem Patapoutian** for their **discoveries of receptors for temperature and touch.**

What are the Key Highlights of Svante Paabo's Research?

- **Human Evolution:** Homo sapiens, **first appeared in Africa approximately 300,000 years ago**, while closest known relatives, **Neanderthals**, **developed outside Africa and populated Europe and Western Asia** from around 400,000 years until 30,000 years ago, at which point they went extinct.
- **Genome Sequencing of Neanderthals:** After sequencing Neanderthals' genes it is found that **archaic gene sequences from our extinct relatives influence the physiology of present-day humans.**
 - For e.g., the **Denisovan version of the gene EPAS1** confers an advantage for **survival at high altitudes** and is common among **present-day Tibetans.**
 - Other examples are Neanderthal genes that **affect our immune response to different types of infections.**
- **Discovery of Denisova:** In 2008, a 40,000-year-old fragment from a finger bone was discovered in the **Denisova cave in the southern part of Siberia.**
 - The DNA Sequencing of this bone had led to the **discovery of a previously unknown hominin, which was given the name Denisova.**
- **Coexistence of Different Human Species:** The **ancestors of modern humans, Neanderthals and Denisovans co-existed for about 20,000 years**, during which they not only interacted with each other **but also inter-bred.**
 - In modern day humans with European or Asian descent, approximately 1-4% of the genome originates from the Neanderthals.
 - Further, gene flow had also occurred between Denisova and Homo sapiens. This relationship was first seen in populations in Melanesia and other parts of South East Asia, where individuals carry up to 6% Denisova DNA.
- **Novel Methodology:**
 - It is **not easy to amplify and sequence ancient DNA** because it is highly fragmented and full of contamination from microbes like fungi and bacteria. Over time, DNA tends to degrade and become chemically modified.
 - Therefore, **Pääbo decided to study mitochondrial DNA from Neanderthals.**

- Mitochondria, popularly called the powerhouse of the cell, is an organelle inside the cell that has its own DNA.
- Although the mitochondrial genome is small and only contains a fraction of genetic information in the cell, it is present in thousands of copies. This increases the chance of its **successful sequencing**.
- **Significance:**
 - The conceptual breakthrough is of paramount importance in **understanding human evolution**.
 - Dr Pääbo's research has **resulted in the rise of a new scientific discipline called Paleogenomics**, which is the study and analysis of genes of ancient or extinct organisms.

Who were Neanderthals?

- Neanderthals, the closest relatives of the present-day human species, lived in Europe and West Asia – as far as southern Siberia and the Middle East – before they disappeared around 30,000 years ago.

UPSC Civil Services Examination Previous Year Question (PYQ)

Prelims

Q. The word 'Denisovan' is sometimes mentioned in media in reference to (2019)

- (a) fossils of a kind of dinosaurs
- (b) an early human species
- (c) a cave system found in North-East India
- (d) a geological period in the history of Indian subcontinent

Ans: (b)

Exp:

- Denisovans are an extinct species of hominid and were close relatives of Neanderthals. They are another population of early human who lived in Asia.
- The Denisovans are a much more recent addition to the human family tree. Paleoanthropologists unearthed a 40,000-year-old adult tooth and an exquisitely preserved fossilized little finger bone that had belonged to a young girl who was between five and seven years old when she died.
- Studies reflect that the girl was closely related to Neanderthals, yet distinct enough to be classified as a new species of archaic humans, which scientists named "Denisovan" after the cave where the bone was found. The Denisovan genome also suggests the young girl had brown hair, eyes, and skin. **Therefore, option (b) is the correct answer.**

Source: TH