Nobel Prize in Chemistry for Decoding Protein Design and Structures

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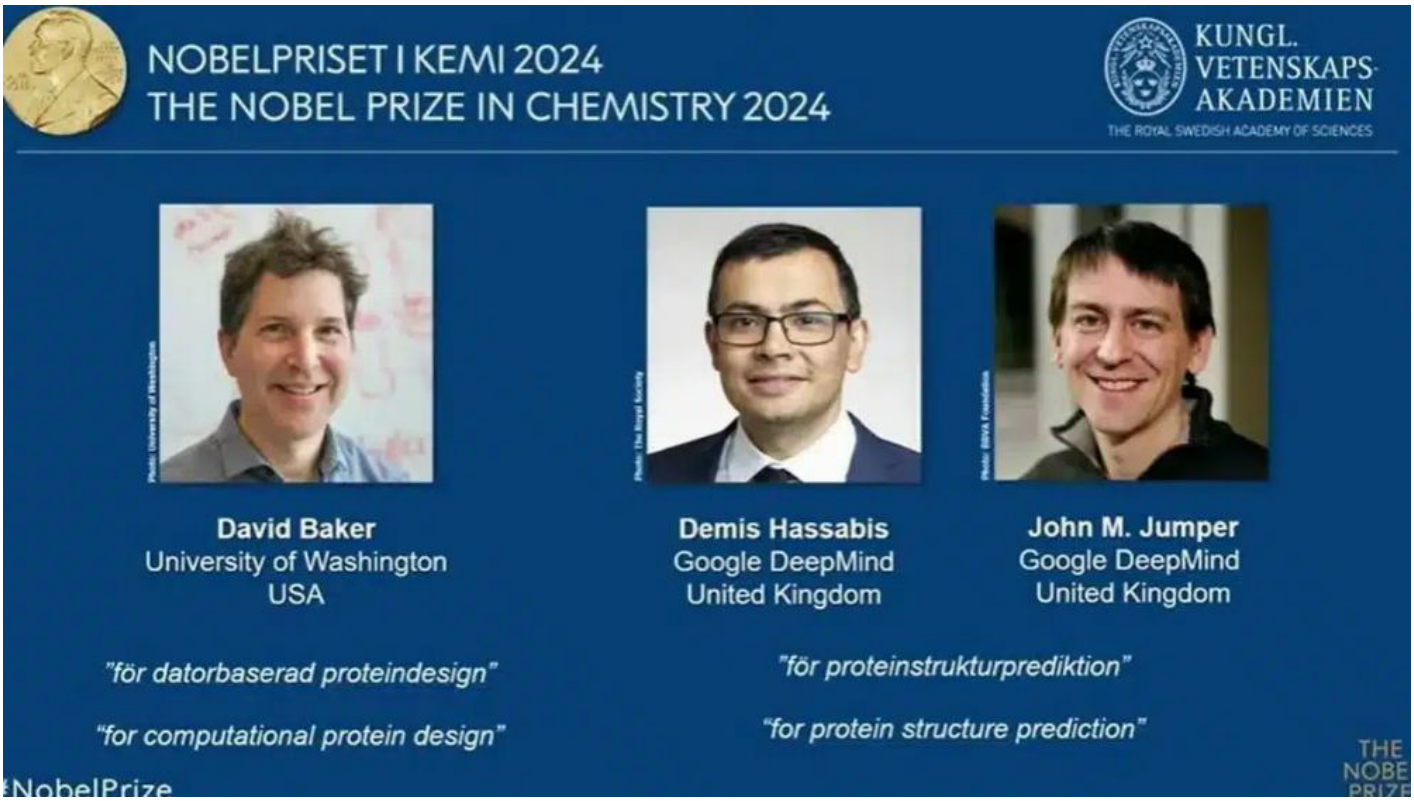

What's in today's article?

- Why in News?
- Why is Work on Protein Important?
- What the 2024 Chemistry Nobel was Awarded For?
- What Makes the 2024 Chemistry Nobel Significant?
- Some Interesting Facts About the 2024 Chemistry Nobel

Why in News?

- The 2024 Nobel Prize for chemistry will be shared by (American scientist) **David Baker** "**for computational protein design**" along with (Briton scientist) **Demis Hassabis and** (American scientist) **John Jumper "for protein structure prediction."**
- Last year the Nobel Prize for Chemistry was jointly awarded to Moungi G. Bawendi, Louis E. Brus and Alexei I. Ekimov for the discovery and synthesis of quantum dots.

Why is Work on Protein Important?

- **The role played by proteins:**
  - Proteins are **vital for life** and participate in nearly all biological processes. **For example:** Haemoglobin transports oxygen and Insulin aids in glucose absorption.
  - Hence, any disruption in protein production can impact human health.
- **Significance of protein structure:**
  - Made of long chains of 20 different amino acids, **their unique sequences determine their structure and function.**
  - Understanding a protein's shape is key to knowing how it works.
- **Challenges in determining protein structure:** Historically, determining protein structures has been slow, often taking months or years using x-ray crystallography.

What the 2024 Chemistry Nobel was Awarded For?

- **For creating innovative tool – AlphaFold:**
  - AlphaFold isan **AI tool** created by Hassabis and Jumper that accurately predicts protein structures in a fraction of the time.
  - It utilises known amino acid sequences to make fast and reliable predictions.
- **For designing new proteins:**
  - Baker created **Rosetta software** to predict protein structures.
  - He used Rosetta to reverse-engineer protein design, allowing the creation of new proteins by entering desired structures.
  - David Baker developed **synthetic proteins** that do not exist in nature.
  - As his methods are more efficient, it allowed for **quicker development of proteins for specific tasks**, like breaking down plastics.

What Makes the 2024 Chemistry Nobel Significant?

- **Simplifies understanding of proteins:** Enhanced visualisation of protein structures helps understand biological functions and disease mechanisms, including antibiotic resistance and microbial degradation of plastics.
- **Key to understanding critical areas:** The ability to design proteins with novel functions opens doors to: **nanomaterials, targeted pharmaceuticals, rapid vaccine development and environmental solutions**.
- **Curing diseases:** These innovations have far-reaching implications for developing new treatments and addressing protein-related diseases.
- **Recognition to AI:** The Nobel Prize emphasises the transformative role of AI in biological research.

Some Interesting Facts About the 2024 Chemistry Nobel:

- **Winners:** Baker works at the University of Washington in Seattle and Hassabis and Jumper work at Google DeepMind in London.

- **Comes relatively quicker:**
  - The Nobel Prize for Hassabis and Jumper comes relatively quickly after the corresponding work (of around 4 to 6 years).
  - **There is usually a gap of a few decades** between the work and the prize because the former doesn't immediately prove to be of greatest benefit to humankind, which is a criterion for winning.
  - **For example**, John Goodenough shared the 2019 chemistry prize for his work on lithium-ion batteries in the late 1970s.
- **Given to non-chemists:**
  - The Chemistry Nobel this year also continues a relatively new tradition in this category of the prize going to non-chemists.
  - In 1981, chemistry laureate Roald Hoffmann interpreted this to be a mark of **chemistry's far and influential reach**, especially in biochemistry and molecular biology.

Q.1. Why is the discovery and synthesis of quantum dots significant?

Quantum dots or semiconductor nanocrystals are semiconductor particles a few nanometers in size with optical and electronic properties that differ from those of larger particles via quantum mechanical effects. They are a central topic in nanotechnology and materials science.

Source: Nobel Prize in Chemistry awarded to David Baker, Demis Hassabis and John Jumper for decoding protein design and structures | IE | NobelPrize