SAINTS PERSPECTIVES

Things Exceptional (Nobel Prizes)

The Nobel Prize in Chemistry 2024

9 October 2024.

The Nobel Prize Committee

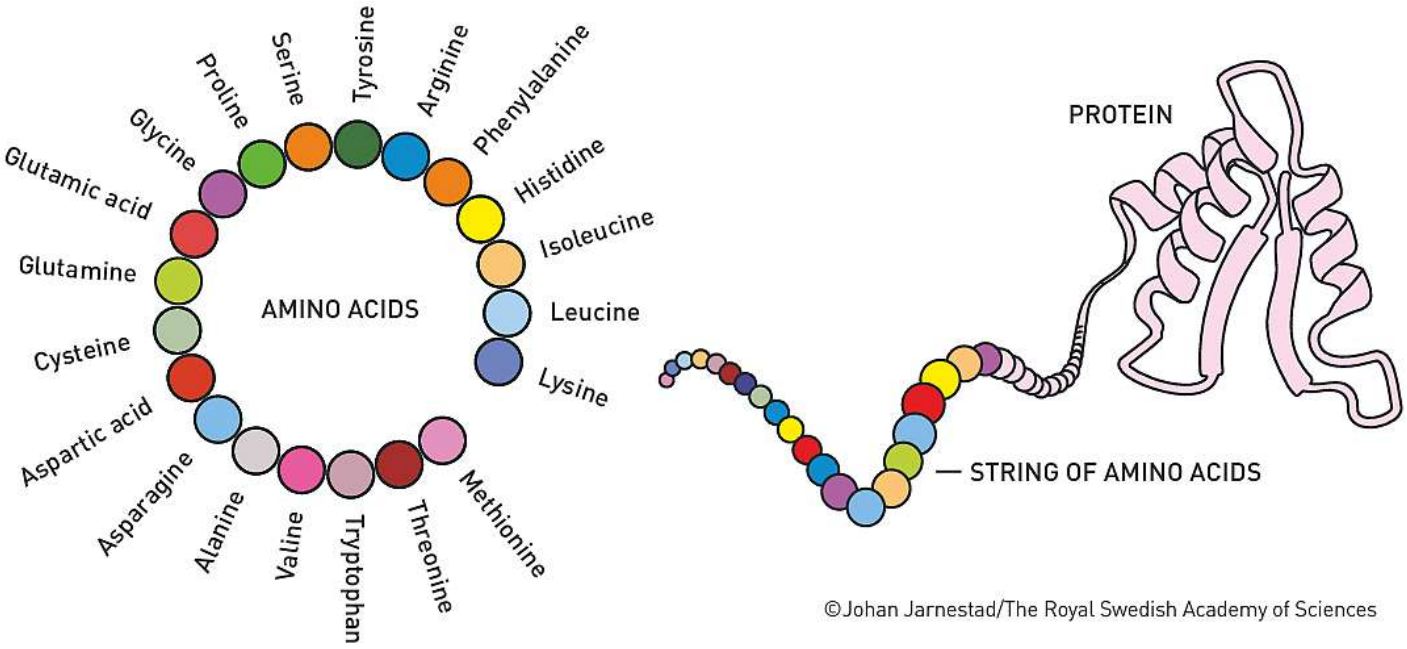
Announced that the 2024 Nobel Prize in Chemistry

with one half to David Baker
“for computational protein design”

and the other half jointly to Demis Hassabis and John Jumper
“for protein structure prediction”

Description

Proteins generally consist of 20 different amino acids, which can be described as life’s building blocks. A protein’s final folded form determines its biological function. In other words, to understand proteins—and, by extension, biology—one must understand their structure.

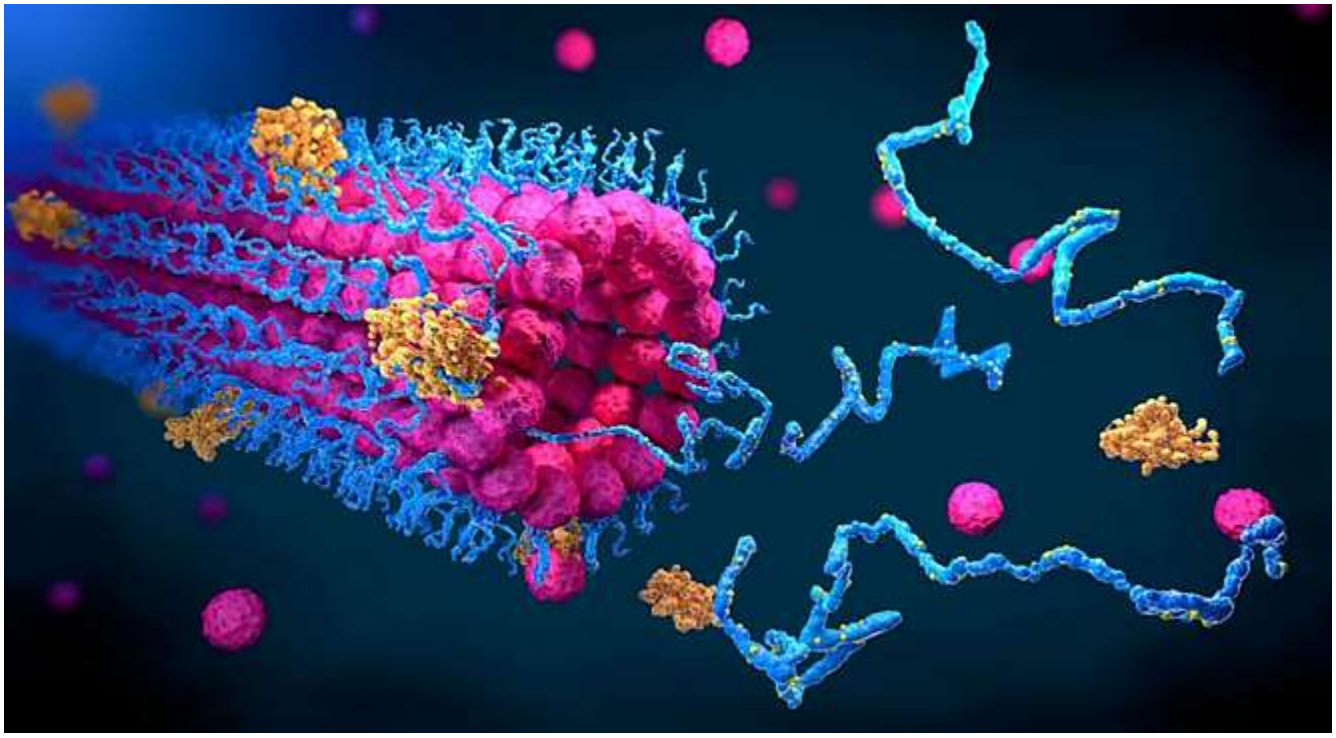


In 2003, David Baker succeeded in using these blocks to design a new protein that was unlike any other protein. Using a computer program he named **Rosetta**, he found an amino-acid sequence capable of folding in ways not seen in nature. Once the sequence was recreated in the lab and the protein formed, he determined its final structure using a technique called X-ray crystallography: it was a close match to what he had set out to make.

Since then, his research group has produced one imaginative protein creation after another, including proteins that can be used as pharmaceuticals, vaccines, nanomaterials and tiny sensors.

Going the other way, and predicting a protein's structure from its amino-acid sequence, is a problem that took even longer to crack. In proteins, amino acids are linked together in long strings that fold up to make a three-dimensional structure, which is decisive for the protein's function.

Since the 1970s, researchers had tried to predict protein structures from amino acid sequences, but this was notoriously difficult. However, four years ago, there was a stunning breakthrough. In 2020, Demis Hassabis and John Jumper presented an AI model called **AlphaFold2**. With its help, they have been able to predict the structure of virtually all the 200 million proteins that researchers have identified.



Getty Images Illustration of proteins folding into their three dimensional structure.

Possible Applications

Rosetta, now called **Rosetta Commons**, has subsequently become a software package used by every protein chemist, and computational protein design has assisted in everything from vaccine development to the detection of toxic chemicals.

SAINTS PERSPECTIVES

Things Exceptional (Nobel Prizes)

Since their breakthrough, **AlphaFold2** has been used by more than two million people from 190 countries. Among a myriad of scientific applications, researchers can now better understand antibiotic resistance and create images of enzymes that can decompose plastic.

AlphaFold 3, released in May, goes beyond proteins to predict the structure of a host of other biomolecules, such as DNA, as well as small molecules that might function as drugs. It can also predict how different molecules with different structures fit together, such as how a virus's spike protein might interact with antibodies and sugars found in the body.

Prize amount:

11 million Swedish kronor, to be shared as defined above between the Laureates.

About the Winners

David Baker, John Jumper and Demis Hassabis

Prof David Baker, works at the University of Washington in Seattle.

Prof John Jumper, works at Google DeepMind, London, United Kingdom

Demis Hassabis was a child prodigy in chess and started playing when he was four and reached master standard at the age of 13. Prof Hassabis grew up in London with Greek-Cypriot and Singaporean parents. He completed his A-levels aged 16 and was asked by Cambridge University to take a gap year due to his young age. Before and after graduating in computer science, he worked in computer game design, winning numerous awards. He then completed a PhD at University College London, before working at several US universities.

In 2010 he co-founded machine learning company **DeepMind** that was bought by Google in 2014.

Previous Winners of the Nobel Prize in Chemistry

- **2023** - **Alexei I. Ekimov, Louis E. Brus and Moungi G. Bawendi**
  - "for their work on semiconducting nanoparticles, known as Quantum dots"
- **2022** - **Carolyn Bertozzi, Morten Meldal and K. Barry Sharpless**
  - "for the development of click chemistry and bioorthogonal chemistry"
- **2021** - **Benjamin List and David W.C. MacMillan**
  - "for the development of asymmetric organocatalysis"
- **2020** - **Emmanuelle Charpentier and Jennifer Doudna**
  - "for the development of a method for genome editing"
- **2019** - **John B. Goodenough, M. Stanley Whittingham and Akira Yoshino**
  - "for the development of lithium ion batteries"

References

Google DeepMind boss wins Nobel for proteins breakthrough
BBC News, Oct 9, 2024
https://www.bbc.com/news/articles/czrm0p2mxvyo

Google's DeepMind researchers among recipients of Nobel prize for Chemistry
The Economist, Oct 9th 2024
https://www.economist.com/science-and-technology/2024/10/09/googles-deepmind-researchers-among-recipients-of-nobel-prize-for-chemistry