

AMERICAN CHEMICAL SOCIETY

Deciphering the Genetic Code

The story begins, yet again, with Avery's discovery that DNA was the molecule which produced inheritable changes. While it took time for people and scientists to absorb the idea of four nucleotides governing the whole of genetic information, scientists like Hershey and Chase were busy reinforcing this milestone discovery. Eventually, James Watson and Francis Crick wowed everyone with their double-helix model and opened doors to more questions.

How did the replication process work? How were amino acids converted to proteins? What was the template for protein synthesis? Nirenberg, even as an outsider in molecular genetics, set out to answer such a question - how does DNA or RNA synthesise proteins?

Nirenberg and Heinrich Matthaei chose a cell-free environment to observe the working of RNA molecules in the cytoplasm. They kept track of proteins and the amino acids formed by tagging them radioactively. The 20 amino acids - the mascots of the "RNA Tie Club" that Nirenberg was not a part of - were added to 20 test tubes, each with a different radioactive acid. Synthetic RNA, when added to a test tube, would produce some protein that could be used to crack the genetic code.

The breakthrough came in the form of a long poly-Uracil chain. The poly-U chain was a messenger to instruct amino acids to add Phenylalanine to the protein. This proved that messenger RNA directed protein synthesis by controlling the amino acids to be added.

After an initially underwhelming response, Nirenberg and Matthaei's experiment was awarded the credit it deserved, and more people began searching for different nucleotide combinations to correspond to amino acids. Four nucleotides in three-lettered Codons became the 64-unit guide to not only 20 amino acids but also the entire genetic code.

This ground-breaking discovery, summarised in a simple, four-columned chart, brought Nirenberg his Nobel Prize (shared with other scientists). He was a man devoted to research, as shown by the fact that he chose to give more time to doing new experiments instead of amassing money through his completed experiment. The ethical issues raised by such an understanding of the genetic code were not ignored either. As it stands, Nirenberg's story teaches us lessons on responsibility towards humankind, devotion to science, accepting outsiders, and, most prominent of all, simplicity. Four nucleotides with twenty amino acids make everything and everyone. Nature has decreed that "Bangs and smoke are more often the marks of ineptitude than expertise."