Nucleic acid synthesis in the study of the genetic code

The aim to obtain a ribopolynucleotidic product with the same chain length as the template used was not fulfilled as many amplifications made the RNA product. The resulting length of more than 100 nucleotides can be explained as, even today, we employ techniques such as primer walking to overcome this barrier.

Overall, it became clear that this repetitive copying by the enzyme could be helpful for message transfer. The team then moved on from their original aim and focused on bettering the conditions of this amplification and studying its consequences.

It was observed that in the chemically synthesised templates if there was a di or tri repeating sequence of nucleotides, the polymerases were sure to produce long chains of DNA or RNA products. Through all this, the team was able to produce a variety of ribopolynucleotides which they used for further experiments.

Khurana also reviewed the use of trinucleotides as codons for amino acid assignments. His experiments involved using polynucleotide chains of repeating nucleotide patterns with lengths 2, 3, and 4. To elaborate, a polymer RNA of the form poly-{UC} would synthesise co-polypeptide sequences of two amino acids. It was observed that any experiment with a ribopolynucleotide containing two nucleotides would invariably result in the incorporation of only and precisely two amino acids in an equimolar amount.

The experiments with repeating tri-nucleotide polymers produced a set of three amino acids, with only polymers poly-rUAG and ply-rAUG being the exceptions and producing a set of two amino acids. For tetra-nucleotide polymers, polypeptides with four amino acids were observed.

All these observations can be and were explained by the property of one tri-nucleotide codon directing the addition of one amino acid. Poly-UC would represent UCUCUCUC... leading to the addition of Serine (UCU) and Leucine (CUC). For poly-UUC, the result was Phenyl Alanine (UUC), Serine (UCU), and Leucine (CUC). Similarly, poly-UAUC resulted in Tyrosine (UAU), Leucine (CUA), Serine (UCU), and Isoleucine (AUC).

The role of start and stop codons has not been forgotten. In experiments with poly-GUA, only two peptides - Valine (GUA) and Serine (AGU) - were obtained since the third combination (UAG) is a stop codon. The lack of start codons to initiate the production of polypeptides was supplemented by the artificially high Mg2+ ion concentration in the E. Coli. environment used.

The love for science, and admiration for the marvel that our living mechanisms are, shines through again as even in the middle of discoveries that could potentially change the entire biology world, Khurana takes a pause to call two enzymes "beautifully precise copying machines".