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DNA is genes and a lot more!

The more we learn the more there is to learn about genetics, says S.Ananthanarayanan.

The cracking of the genetic code was a breakthrough and with the mapping of the genome, it was believed that we were ‘almost there’. New research reveals that we have just scratched the surface.

DNA structure

The thing about the chromosome, the giant molecule that carries genetic information, is that it was found to have simple and systematic structure. It consists of just a backbone, a chain of sugar molecules, linked by phosphate (or phosphorus and oxygen) groups. To each sugar molecule is connected one of just four kinds of chemical groups, known by the initial letters, A, G, T, C, of their names.

Just this much complexity permits the million-unit long chains to code for the sequence of amino acids that make up millions of proteins, enzymes, to make each kind of living cell perform a distinct and definite function. Researchers soon worked it out that groups of three consecutive sugar molecules coded for either an amino acid and the start or end of the list of amino acids in a protein.

With the identification of the groups that meant different things, the job of working out the meaning of each part, known as a gene, of the DNA could be taken up – the decoding of the human genome.

Sense and nonsense

This much, what we have talked about so far, that is, is the part of the DNA molecule that makes sense. These comprehensible parts, denoted by ‘start’ and ‘end’ codons, or ‘groups or three’, all correspond to particular enzymes or have identifiable functions. But this part is only a fraction of the DNA molecule. Between these parts, are vast tracts of ‘nonsense’ code. Called nonsense because no function has been attached to these parts.

One view was that this extent of garbage was for the protection of the important parts. If, during cell division, a part of the DNA were corrupted, then the mishap was more likely to be in the extensive, un-important portions and damage to the vital areas could be ‘contained’. The ‘important parts’ also showed redundancy, or ‘safeguards’, in the way they were built, so that errors during transmission would not destroy their meaning.

New light on nonsense

It has now been discovered that within this mass of nonsense are found patches where the structure is ***exceedingly*** stable, even if undecipherable. By stable is meant, exactly the same, not

just in the DNA of a species, but even across different species that are considered to have evolved in series.

For instance, in the genome sequence of mouse, rat and man, there is 85% similarity. This means the difference between man and the rodents is expressed in the 15% where genes are different and code for what tells the species apart.

But between the same 3 species, 480 regions in the 'nonsense' part have been discovered to be ***100% identical***. This means that while mutations were allowed in the 'useful' genes, allowing the species to evolve, in these 'ultraconserved' regions, no compromise was permitted. The regions are also largely the same in chicken, dog and fish sequences. This indicates that the regions have been preserved for over 400 million years, the time since humans parted ways with fish along the path of evolution.

There's something big down there

What uncanny survival value lies hidden in these regions, that they remained unchanged for 400 million years? Do they control the way the 'important' genes function? Do they play a role in the transfer of gene patterns for the synthesis of proteins in cells?

Another role may be to control the sequence of embryonic development. This course is remarkably similar in animals from fish to humans. There is evidence that a known 'ultraconserved' part directs the gene that plays a role in the growth of the brain and limbs.

There is a whole lot to be done after the Human Genome Project!