'Junk DNA' uncovers the nature of our ancient ancestors

October 20 2010

The sea lamprey

The key to solving one of the great puzzles in evolutionary biology, the origin of vertebrates -- animals with an internal skeleton made of bone -- has been revealed in new research from Dartmouth College and the University of Bristol.

Vertebrates are the most anatomically and genetically complex of all organisms, but explaining how they achieved this complexity has vexed scientists. The study, published today [20 October] in Proceedings of the National Academy of Sciences claims to have solved this scientific riddle by analysing the genomics of primitive living fishes such as sharks and lampreys, and their spineless relatives such as sea squirts.

Alysha Heimberg of Dartmouth College and colleagues studied the family relationships of primitive vertebrates. The team used microRNAs, a class of tiny molecules only recently discovered residing within what has usually been considered 'junk DNA', to show that lampreys and slime eels are distant relatives of jawed vertebrates.

Alysha said: “We learn from our results that lamprey and hagfish are equally related to jawed vertebrates and that hagfish are not representative of a more primitive vertebrate, which suggests that the ancestral vertebrate was more complex than anyone had previously thought.

“Vertebrates have been evolving for hundreds of millions of years but still express the same microRNA genes in the same organs as when they both first appeared.”

The team went on to test the idea that it was these same ‘junk DNA’ genes, microRNAs, which were responsible for the evolution origin of vertebrate anatomical features. They found that the same suite of microRNAs were expressed in the same organs and tissues, in lampreys and mice.

Co-author, Professor Philip Donoghue of the University of Bristol’s School of Earth Sciences, said: “The origin of vertebrates and the origin of these genes is no coincidence.”

Professor Kevin Peterson of Dartmouth College said: “This study not only points the way to understanding the evolutionary origin of our own lineage, but it also helps us to understand how our own genome was assembled in deep time.”

Provided by University of Bristol