The amazing amphioxus: Evolutionary leap over 500 million years ago gives new insights into human diseases

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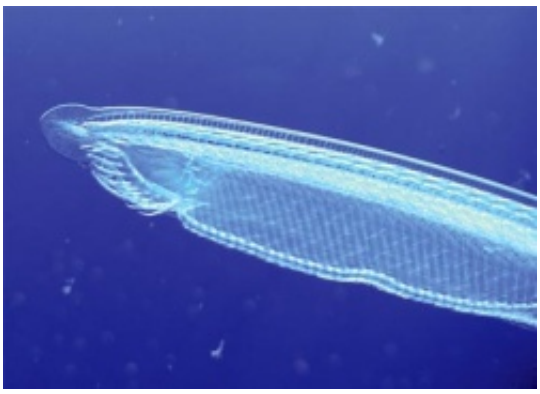

Picture is of amphioxus.

(Phys.org) -- An evolutionary leap made at the bottom of the ocean over 500 million years ago gives new insights into the causes of human diseases such as diabetes, cancer and neurological disorders, according to newly published research from scientists at the Universities of St Andrews and Dundee.

Vertebrates emerged around 500 million years ago from a massive evolutionary upheaval that involved two successive doublings in the amount of DNA in a marine invertebrate. These dramatic events triggered the evolution of a new animal, which became the ancestor of the backboned fishes, birds, reptiles and mammals, including humans.

“Amazingly, what happened so long ago still affects the life and diseases of modern humans,” said Professor Carol MacKintosh, of the College of Life Sciences at the University of Dundee.

The new research, published in the Royal Society journal *Open Biology*, proposes how these ancient DNA doublings boosted internal communication systems. The result is that cells in our bodies are far better at integrating information than even the smartest smartphones.

Such complexity is needed to coordinate the actions of our elaborate human bodies. The downside is that communication breakdowns cause diabetes, cancer and neurological disorders.

Researchers have been able to compare the human genome to the recently decoded genetic sequence of the invertebrate amphioxus, a tiny creature still found in our seas and which can be regarded as a 'distant cousin’ to our species.

“The ancestors of amphioxus did not go through the two rounds of genome duplication, so it is still quite similar to the original spineless creature,” said Professor MacKintosh.

“You can still see the 'family resemblance' between amphioxus and humans, because like us, it has a nerve cord running down its back, blocks of muscle, and branchial arches where we have facial structures.

“However, unlike humans, amphioxus has no bones, no brain, no face and no heart. It is because of the two genome duplications that we gained the complexity to develop all these features.

“We study the complicated human systems that go wrong in diabetes and cancer. Now we will also look closely at this simpler animal to accelerate our understanding of human cells. We already have clues about

important questions such as why did only certain genes survive the DNA doublings, how did they shape vertebrate evolution, and what is their impact on human health and diseases?"

Dr Ferrier, of The Scottish Oceans Institute at St Andrews, added, "Amphioxus is proving to be an excellent animal with which to understand various aspects of the evolution of vertebrate genomes, including the human genome. This is particularly true for families of genes that increased in size and complexity during vertebrate evolution.

"Analysis of these gene families from an evolutionary point of view helps to navigate through the increasingly large data sets on protein interactions in a more focused and productive way, speeding the way towards establishing the links between particular proteins and diseases as well as highlighting new potential disease targets.

Provided by University of St Andrews

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