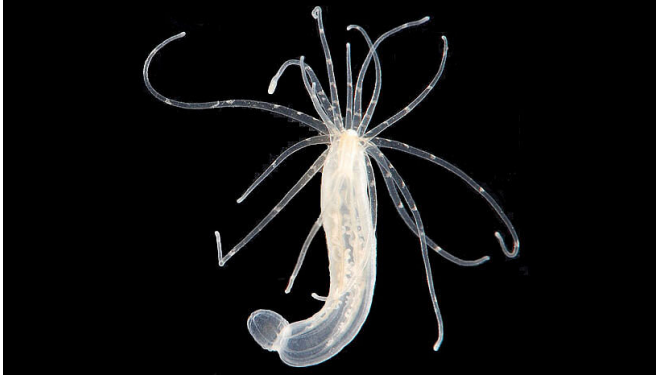


Symphony of genes

5 August 2019



Ancient animal genomes genes, which have been detected in the sea anemone *Nematostella vectensis*, live and play together. Credit: Robert Aguilar, Smithsonian Environmental Research Center, CC BY 2.0

One of the most exciting discoveries in genome research was that the last common ancestor of all multicellular animals—which lived about 600 million years ago—already possessed an extremely complex genome. Many of the ancestral genes can still be found in modern day species (e.g., human). However, it has long been unclear whether the arrangement of these genes in the genome also had a certain function. In a recent study in *Nature Ecology and Evolution*, biologists led by Oleg Simakov and Ulrich Technau show that not only individual genes but also these gene arrangements in the genome have played a key role in the course of animal evolution.

Genomes store the instructions for how to build an organism. Often only individual [genes](#) are associated with certain functions. However, the [genome](#) not only defines single genes but also tells us about their [arrangement](#) on the DNA. Remarkably, many of these arrangements have been preserved from the genome of the common ancestor of sponges and humans, over 600 million years ago. Despite this, their potential function has long eluded scientists.

What gene arrangements reveal

In their current study, the team from the Department of Molecular Evolution and Development at the University of Vienna has now uncovered the first insights into this question. Using comparative genomic analyses, the researchers reconstructed evolutionarily conserved gene arrangements in animals and investigated their activity in different cell types. They could show that genes that are always present together in the genome in several species, also tend to be active in the same [cells](#). For example, three genes that have been adjacent in several species (e.g., in sponges or cnidarians) for 600 million years are primarily active in a digestive cell type. "Cell types in animals can thus be characterized not only by individual genes but also by specific gene arrangements, and different cell types are also capable of accessing different regions in the genome," explains Oleg Simakov, evolutionary biologist at the University of Vienna. In addition, the team noted that certain cell types seem to utilize such conserved regions more than others, and thus may represent very ancestral functions.

The results show that not only gene loss or the emergence of new genes have played an important role in evolution, but also the changes in the arrangement of genes in the genome have made a significant contribution. "The study thus opens up a far-reaching perspective on investigating the functions of these regions in the respective [cell types](#)," concludes Simakov.

More information: Bob Zimmermann et al. Ancient animal genome architecture reflects cell type identities. *Nature Ecology & Evolution*. DOI: [10.1038/s41559-019-0946-7](https://doi.org/10.1038/s41559-019-0946-7)

Provided by University of Vienna

APA citation: Symphony of genes (2019, August 5) retrieved 24 November 2020 from <https://phys.org/news/2019-08-symphony-genes.html>

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