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TOWARDS A GENETIC MAP OF THE MICROSCOPIC LIVING WORLD

Researchers at the University of Geneva and the French CNRS (*Centre national de la recherche scientifique in France*) are piloting an international program whose goal is to establish an inventory of eukaryotic microorganisms using DNA barcodes.

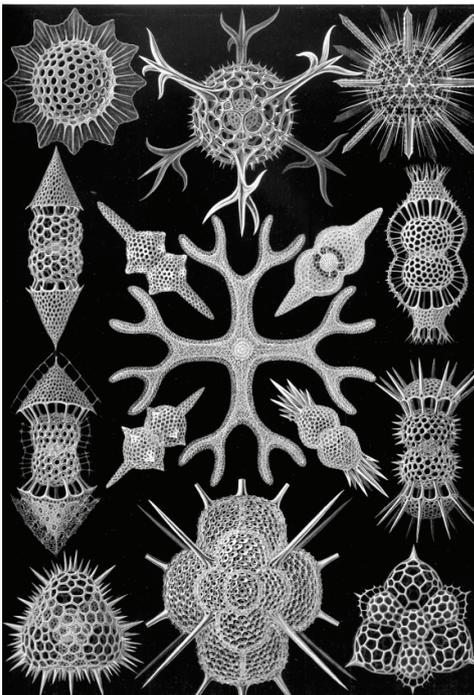
Nobody knows the extent of the richness of our planet's protists, a group that brings together all microorganisms with a distinct intracellular nucleus. This heterogeneous lot, a real gem of biodiversity in terms of numbers of species, still conceals most of its secrets. In order to shed light on this invisible world, and given the importance of certain groups of protists, an international program involving 24 institutions was established by Jan Pawlowski, professor at the Faculty of Science of the University of Geneva (UNIGE), and Colombar de Vargas, research director at CNRS at the Biological Station of Roscoff (Brittany). This comprehensive initiative is detailed in the journal *PLoS Biology*, November 6, 2012. It aims to establish a reference library of «DNA barcodes», which will allow researchers to survey the immense diversity of protists and therein identify unknown species to ultimately assess their role in ecosystems.

Virtually the entire visible biosphere is composed of animals, plants and fungi, which also represent the majority of catalogued species. These three kingdoms, however, only constitute a part of the eukaryotes, or all living organisms other than bacteria and viruses. The true diversity of eukaryotes is, indeed, in a world invisible to the naked eye, that of the protists.

Protists are a set of mostly unicellular and extremely diverse microorganisms. Having an intracellular nucleus, these microscopic entities are structurally more complex than bacteria, which appeared earlier in the course evolution. «Only about 75,000 species of protists have been described so far, yet the crucial importance of certain lineages is already established, whether as pathogens, as indicators of ecosystem quality, or as markers of environmental change», explains Jan Pawlowski, professor in the Department of Genetics and Evolution at UNIGE. To cite but two examples, some protists, notably plankton, produce half of the planet's oxygen, while others, such as the malaria parasite, kill hundreds of thousands of people each year.

The unknown extent of biodiversity

Known species of protists represents only 4% of the approximately 2 million eukaryotes surveyed. However, estimates based on DNA analysis of soil, water or sediment samples indicate that the number of protist species is actually much higher than that of all species of animals, plants and fungi combined. «Protists in fact constitute more than two thirds of eukaryotic species in all known environments, and preliminary censuses by high speed DNA sequencing suggest that there are probably tens of millions of species on a global scale» states Colombar de Vargas, research director at CNRS. These staggering numbers reflect the hitherto totally underestimated importance of



Radiolara belong to protists. Image: Haeckel

these Lilliputian organisms in terms of ecology and evolution.

Biodiversity in barcodes

The researchers intend to shed light on this invisible world with the aid of genetic «barcodes», or DNA sequences that vary between species, but are conserved within a species. «Our consortium, consisting of 24 institutions, has begun a complete inventory of all existing barcodes specific to protists, and offers a unique protocol to establish a reference database for all known lineages,» reports Jan Pawlowski.

This reference library, to which also contribute three researchers from the University of Neuchâtel, will serve as a Rosetta Stone to discover and classify all the species present in a given environment. The creation of an encyclopaedia of the invisible, planned on a global scale, will open up enormous opportunities for research and applications.

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