

PRESS RELEASE

The Proteus genome, one of the largest animal genome known, has been sequenced.

A collaborative project between the University of Ljubljana, Slovenia, Aarhus University, Denmark, and BGI Research, China, will unveil the information encoded in the genome of Proteus, an iconic cave salamander.

The Proteus Genome Project (PGP)

Proteus (*Proteus anguinus*), also known as the olm is an extraordinary animal, whose genome sequence is of great interest to the scientific community, because it holds promises for future discoveries regarding proteus' extraordinary evolution and adaptations to cave life. Furthermore, understanding of the development of this underground amphibian, including in particular its ability to regenerate lost or damaged parts of its body, is expected to help innovation of new medical treatments of conditions requiring regenerative medicine and other human diseases, as well as a better understanding on aging and how to delay it.

Until now, this was but wishful thinking, as the enormous genome size, surpassing the human genome by 15 times, presented a sequencing task too formidable to any scientific institution. To overcome the challenges presented by the largest genome ever sequenced, the Proteus Genome Project is employing cutting edge DNA nanoball sequencing technologies (DNBseq™) developed at MGI Tech (MGI), a subsidiary of the BGI Group, combined with BGI's vast sequencing and computational resources. Over a trillion (10^{12}) nucleotides (the chemical letters specifying the information in the genome) were sequenced using different DNBseq™ techniques. It means that on average, every nucleotide was read 160 times, and this data is now being combined into a final genomic sequence.

The species and its significance

Proteus is not only the largest cave animal but also has the longest life span of all amphibians. With record ages of over 100 years, it exceeds other salamanders by four times. Moreover, it shows negligible signs of aging and within the PGP scientists are hoping to find clues about proteus longevity and how these may be relevant for the health and wellbeing of human beings.

Proteus can withstand years of starvation while it overeats when food is abundant. It is a mystery how this animal can remain perfectly healthy and long-lived despite extreme weight loss or obesity. The genomic data that have just become available will ease the search for the mechanisms behind these remarkable capacities.

Proteus's ability to completely regenerate damaged or even missing limbs or other parts of its body is expected to help understanding the pluripotency of adult body cells. This is one of the great hopes of modern medicine, and the genome of proteus might contribute pieces to this puzzle.

On the biodiversity side, proteus is endemic to the caves of the Dinaric Karst on the Balkan Peninsula, and is especially abundant in Slovenia. It is one of the country's iconic symbols, representing its rich natural heritage, including the immense biodiversity of subterranean fauna and pristine sources of water. As one of the most remarkable and renowned representatives of subterranean life worldwide, it acts as a flagship species for the conservation of subterranean environments in general. Proteus itself is endangered, and some populations have experienced critical declines due to pollution and habitat destruction. The PGP will provide a means to assess the evolutionary status of those populations, determine their demography and develop optimal conservation strategies.

The collaboration

China and Slovenia both hold large and globally significant areas of karstic landscapes. PGP builds upon a long history of collaboration between the countries aimed at the scientific exploration and conservation of the precious natural resources of karst ecosystems.

BGI, an institute established two decades ago as the Chinese partner of the international consortium that sequenced the first human genome, is today one of the largest DNA sequencing institutions in the world and is at the forefront of the genetic research in several scientific disciplines. The collaboration between University of Ljubljana and BGI on the Proteus Genome Project combines the highest level of expertise in the fields of DNA sequencing, genomics and the biology of cave organisms, aiming at both scientific excellence and benefits to the society.

The key individuals involved in or supporting the Proteus Genome Project are:

From Slovenia, University of Ljubljana: Nina Gunde-Cimerman, Rok Kostanjšek, Peter Trontelj, Cene Gostinčar, Lila Bizjak Mali, Hans Recknagel, and prof. Emil Erjavec (the Dean of the Biotechnical Faculty).

From China and Denmark: Duncan Yu (Executive Vice President, MGI Tech), Lars Bolund (Aarhus University, Denmark; Lars Bolund Institute of Regenerative Medicine, BGI-Qingdao, China), Huanming Yang (chairman of BGI Group, China), Xun Xu (CEO of BGI Group), Xin Liu (Director of BGI-Qingdao), Yonglun Luo (Executive Director of Lars Bolund Institute of Regenerative Medicine; Associate Professor at Aarhus University), Boerge Diderichsen (Aarhus University), and Frederick Charles Dubee (BGI Advisory Board, Finland).

For further information please see <https://www.proteusgenome.com/> or contact Prof. Rok Kostanjšek Rok.Kostanjsek@bf.uni-lj.si or Prof. Nina Gunde-Cimerman Nina.Gunde-Cimerman@bf.uni-lj.si.