PRESS RELEASE

THE HUMAN PROTEIN ATLAS

One step closer to understanding the human brain

Published today in the journal Science, the Brain Atlas resource is the latest database to be released by the Human Protein Atlas program, which is based at the Science for Life Laboratory (SciLifeLab), a joint research center aligned with KTH Royal Institute of Technology, Karolinska Institutet, Stockholm University and Uppsala University. The project is a collaboration with the BGI research center in Shenzhen and Qingdao in China and Aarhus University in Denmark.

The brain is the most complex organ of our body both in structure and function, and a dedicated brain atlas has therefore been created combining data from the human brain with corresponding information about the brain of pig and mouse. Mathias Uhlén, Director the Human Protein Atlas effort, says: "As expected the blue print for the brain is shared among mammals, but the new map also reveals interesting differences between the brains of human, pig and mouse". The open-access database offers medical researchers a resource to deepen their understanding of neurobiology.

The Brain Atlas resource is based on the analysis of nearly 1,900 brain samples covering 27 brain regions in three species. Dr. Evelina Sjöstedt, researcher at the Department of Neuroscience at Karolinska Institutet and first author on the paper says: "Cerebellum emerges in the present study as the most distinct region of the brain and many proteins with elevated expression levels in this region were found, including several genes associated to psychiatric disorders supporting a role of the cerebellum in processing of emotions." Another interesting finding is that the different cell-types of the brain share specialized proteins with peripheral organs. For example, astrocytes, the cells that 'filter' the extracellular environment in the brain share a lot of transporters and metabolic enzymes with liver, the organ that is important for filtering blood.

When comparing the neurotransmitter systems, responsible for the communication between neurons, some clear differences could be identified, especially regarding the receptors that respond to released neurotransmitters and neuropeptides. Dr. Jan Mulder, group leader of the Human Protein Atlas brain profiling group and researcher at the Department of Neuroscience at Karolinska Institutet says: "Several molecular components of neurotransmitter systems, especially receptors, show a different pattern in humans and mice which means that caution should be taken when selecting animals as models for human mental and neurological disorders."

The results are presented in the Human Protein Atlas (www.proteinatlas.org/brain) providing an open-access knowledge resource to allow exploration of the gene expression profiles across human, pig and mouse brain regions. For selected genes, the Brain Atlas also contains microscopic images showing the protein distribution in human brain samples and detailed, zoomable maps of protein distribution in the mouse brain.

The project was a combined effort of SciLifeLab (Sweden), the KTH-Royal Institute of Technology, Karolinska Institutet, Uppsala University, and Aarhus University (Denmark) and BGI-Shenzhen & BGI-

Qingdao (China). The main funding for the research was provided by the Knut and Alice Wallenberg Foundation.

Read the full article: Sjöstedt et al (2020) "An atlas of the protein-coding genes in human, pig and mouse brain" Science 367

About

Human Protein Atlas

The Human Protein Atlas (HPA) is a program based at the Science for Life Laboratory (Stockholm) and started in 2003 with the aim to map all of the human proteins in cells, tissues and organs using integration of various omics technologies, including antibody-based imaging, mass spectrometry-based proteomics, transcriptomics and systems biology. All the data in the knowledge resource is open access to allow scientists both in academia and industry to freely use the data for exploration of the human proteome. Version 19 consists of six separate parts, each focusing on a particular aspect of analysis of the human proteins: (i) the Tissue Atlas showing the distribution of the proteins across all major tissues and organs in the human body; (ii) the Cell Atlas showing the subcellular localization of proteins in single cells; (iii) the Pathology Atlas showing the impact of protein levels for survival of patients with cancer; (iv) the Blood Atlas showing the profiles of blood cells and proteins detectable in the blood; (v) the Brain Atlas showing the distribution of proteins in human, mouse and pig brain; and (vi) the Metabolic Atlas showing the presence of metabolic pathways across human tissues. The Human Protein Atlas program has already contributed to several thousands of publications in the field of human biology and disease and it has been selected by the organization ELIXIR (www.elixireurope.org) as a European core resource due to its fundamental importance for a wider life science community. The HPA consortium is funded by the Knut and Alice Wallenberg Foundation.

For more information, see: www.proteinatlas.org

Knut and Alice Wallenberg Foundation

The Knut and Alice Wallenberg Foundation is the largest private financier of research in Sweden and also one of Europe's largest. The Foundation's aim is to benefit Sweden by supporting basic research and education, mainly in medicine, technology, and the natural sciences. The Foundation can also initiate grants to strategic projects and scholarship programs.

For more information, see: kaw.wallenberg.org

Science for Life Laboratory

Science for Life Laboratory, SciLifeLab, is a research institution for the advancement of molecular biosciences in Sweden. SciLifeLab started out in 2010 as a joint effort between four universities: Karolinska Institutet, KTH Royal Institute of Technology, Stockholm University and Uppsala University. The center provides access to a variety of advanced infrastructures in life science for thousands of researchers creating a unique environment for health and environmental research at the highest level.

For more information, see: www.scilifelab.se

Karolinska Institutet

Karolinska Institutet is one of the world's leading medical universities. Our vision is to advance knowledge about life and strive towards better health for all. As a university, KI is Sweden's single largest center of medical academic research and offers the country's widest range of medical courses and programs. Since 1901 the Nobel Assembly at Karolinska Institutet has selected the Nobel laureates in Physiology or Medicine.

For more information, see: www.ki.se

KTH–Royal Institute of Technology

Since its founding in 1827, KTH Royal Institute of Technology in Stockholm has grown to become one of Europe's leading technical and engineering universities, as well as a key center of intellectual talent and innovation. We are Sweden's largest technical research and learning institution and home to students, researchers and faculty from around the world dedicated to advancing knowledge.

For more information, see: www.kth.se

Uppsala University

Uppsala University is the Nordic region's oldest university – founded in 1477 – and is ranked among the top 100 universities in the world. Uppsala University is divided into three disciplinary domains: humanities and social sciences, medicine and pharmacy, and science and technology. These in turn consist of nine faculties and nearly 50 departments in total.

For more information, see: www.uu.se

BGI

Funded in 1999, BGI is a leading life science and genomics organizations. BGI's mission is to use genomics to benefit mankind and to be a leader in the era of life sciences and committed to applying its genetic and technological achievements to real world settings in order to realize the dream of trans-omics for a better life.

For more information, see: en.genomics.cn

Aarhus University

Founded in 1928, Aarhus University has grown to become a leading public research university with international reach covering the entire research spectrum. The university is divided into five faculties: Arts, Business and Social Sciences, Health, Natural Sciences, and Technical Sciences.

For more information, see: www.au.dk