

THE HUMAN PROTEIN ATLAS

A 20-year journey with the Human Protein Atlas

[November 19, 2020]. 20 years ago, the Human Protein Atlas initiative started and to celebrate this event, the journal *Science* has today published a booklet “The Human Protein Atlas – a 20-year journey into the body”. In addition, a “microsite” is introduced that combines facts with breath-taking videos of the human body. In total, eleven movies are being published that explore the human body using a novel technology for 3D-imaging based on light-sheet microscopy. Furthermore, a new version 20 of the open access Human Protein Atlas has been launched, adding a new Single-Cell Type Atlas to allow the exploration of all human genes in 192 different human cell types. The new version also includes a new subcellular localization “nucleolus rim” in the Cell Atlas and a detailed analysis of the human prefrontal cortex, a complex brain region involved in cognitive and emotional processes and psychiatric disorders.

In an expansive supplement published by *Science* and American Association for Advancement of Science (AAAS), a journey is taken through the 20 years since the establishment of the Human Protein Atlas (HPA) consortium to underscore milestones reached and celebrate updates, releases and additions to the atlas. For the reader’s convenience, reprints of the relevant journal articles associated with the most important of these milestones are provided.

“It is our hope that this publication will not only be a useful reference, but will also give readers a sense of the enormity of the task undertaken by the Human Protein Atlas project, the extraordinary advances that have resulted from it, and the crucial information that this database provides for researchers everywhere”, says Dr Sean Sanders, Senior Editor for Custom Publishing at the journal *Science* and project leader for the booklet.

3D-based movies – journeys into the human body

In addition, a microsite has been launched in collaboration with the *Science*/AAAS using the Ceros software platform. In this knowledge-based portal, important discoveries made by the HPA program can be found. In addition, various movies based on 3D immuno-imaging and light sheet microscopy generated by the HPA group can be explored. These movies include breath-taking journeys into the human body and descriptions of various neurological diseases that allow exploration of the human body down to the single cell level. Each video can be used as educational material to learn more about human biology and they are accompanied by an interview with a scientist to explain the visual content to a non-expert audience.

“It is exciting to see the results of the light sheet microscopy technology, allowing new detailed analysis of proteins in tissues”, says Dr Csaba Adori, Department of Neuroscience, Karolinska Institutet, responsible for the microscopy analysis. All movies are available at the interactive, open access Human Protein Atlas (see link below).

A new open-access Single Cell Type Atlas

A new version 20 of the open access Human Protein Atlas has also been launched, adding a new Single-Cell Type Atlas to allow researchers to explore the expression of all human protein-coding genes in 192 individual cell type clusters. This knowledge-based portal combines single-cell transcriptomics analysis with spatial antibody-based protein profiling to create a high-resolution, single-cell type map of human tissues. The analysis highlights distinct expression clusters corresponding to cell types sharing similar functions, both within the same organs and between organs.

“We are excited to launch the new open access Single Cell Type Atlas as part of the HPA program, highlighting genes elevated in single human cell types and linking this with corresponding data on the protein level. This provides a major resource for understanding cell type specificity, which is important for further characterization of protein function,” says Dr Cecilia

Lindskog, head of the HPA Tissue profiling group at the Department of Immunology Genetics and Pathology, Uppsala University.

New insights into the chemical anatomy of the human prefrontal cortex

In addition, a transcriptomics analysis is presented to identify the molecular profiles of all protein-coding genes in 17 human prefrontal cortex subregions and 3 cortical reference regions. The human prefrontal cortex is a complex brain region, involved in cognitive and emotional processes and psychiatric disorders. A genome-wide, open-access resource is presented as part of the Human Protein Atlas, demonstrating generally higher peptide expression levels versus reference cortices, as well as unique subregional distribution patterns.

“The data present detailed insights into the chemical anatomy of the human prefrontal cortex,” says professor Tomas Hökfelt, Department of Neuroscience, Karolinska Institutet. “This suggests that the spectrum of peptidergic systems may fine tune/modulate functions that are executed during health and disease.”

New insights into the spatial organization of the nucleolus

A new cellular localization is also introduced as part of the HPA Cell Atlas. Nucleolus is responsible for ribosome synthesis and assembly in the cell, but is also involved in cell cycle control and stress response. In version 20, a fourth subcompartment of the nucleolus is introduced, called nucleolus rim.

“We hope that this new nucleolar map will be of use for researchers studying nucleolar functions as well as those studying phase separation and how membrane-less organelles, such as the nucleoli and mitotic chromosomes, form.”, says Professor Emma Lundberg, responsible for the HPA Cell Atlas at SciLifeLab in Stockholm.

One of the world’s most visited biological databases

Version 20 also contains a lot of new information within the various parts of the Human Protein Atlas, including revised summary pages for all human protein-coding genes and a revised dictionary for educational purposes.

“We are excited about these new additions to the Human Protein Atlas and that the HPA program, after 20 years of focused and diligent research, has become one of the world’s most visited biological databases, contributing to thousands of publications every year around the world in the field of human biology and disease”, says Mathias Uhlén, Director of the Human Protein Atlas consortium. The work was funded by the Knut and Alice Wallenberg Foundation.

Additional information:

Webinar: https://www.proteinatlas.org/news/press+room#hpa_20_release_webinar

Booklet: https://www.proteinatlas.org/download/HPA_-_a_20-year_journey_into_the_body.pdf

Microsite: <https://hpajourney.proteinatlas.org/>

Movies: <https://www.proteinatlas.org/learn/videos>

Single Cell Type Atlas: <https://www.proteinatlas.org/humanproteome/celltype>

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About

Human Protein Atlas

The Human Protein Atlas (HPA), initiated in 2000 and funded from 2003, is a program based at SciLifeLab (Science for Life Laboratory), Stockholm, with the aim to map of all 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 access the data for exploration of the human proteome. 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.elixir-europe.org) as a European core resource due to its fundamental importance for the 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: <https://kaw.wallenberg.org/en>

SciLifeLab (Science for Life Laboratory)

SciLifeLab is an 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 for advance infrastructure in life science for thousands of researchers creating a unique environment for health and environmental research at the highest level. The Human Protein Atlas is one of the Research Community Programs with funding from the SciLifeLab.

For more information, see: www.scilifelab.se