# THE HUMAN CELL

Cells are the machinery of life. Much of the bustling activity in the human cell results from proteins performing specific tasks in designated compartments, the organelles. This poster describes the results and ongoing creation of an image-based atlas of the subcellular distribution of the human proteome. Explore it further at www.proteinatlas.org.

## THE HUMAN **PROTEIN ATLAS**

The Human Protein Atlas presents the translated human genome captured in millions of images collected using high-resolution microscopy. The Cell Atlas, Tissue Atlas, and Cancer Atlas provide a comprehensive overview of gene expression-together with the spatial distribution of corresponding proteins-across organs, tissues, and cell lines at subcellular resolution.

### ORGANELLE PROTEOME

The cellular function of proteins is dictated by their location and interactions with other proteins or substrates. Revealing the human proteome's spatial distribution is thus essential to understanding cell biology. By visualizing the nonsecreted human proteome using high-resolution confocal microscopy, the molecular composition of organelles and substructures has been determined



### MULTILOCALIZING PROTEOME

Over one-third of human proteins are found in multiple organelles. The presence of a single protein at several locations may reflect its dynamic distribution, and suggests multiple roles in cell physiology. Understanding the multilocalizing proteome is key for discover ing novel pathways underpinning cellular dynamics and developing a holistic view of the human cell.

PLASMA MEMBRANE

MITOCHONDRI

### **CELL CYCLE-DEPENDENT PROTEOME**

The cell cycle describes the process by which cells grow and divide. This dynamic and tightly regulated process drives changes in abundance and spatial redistribution of many proteins. Cell cycle dysregulation can lead to diseases such as cancer. Knowledge about the cell cycle proteome is therefore essential for understanding health, aging, and disease.

### **CELL LINE** TRANSCRIPTOME

Expression of protein-coding genes has been analyzed in a large set of human cell lines of different cellular origins. One-third of all genes are differentially expressed, indicating cell type-specific functions related to the origin of the cell line. The majority of enes are expressed in all cells and drive rudimentary processes such as metabolism or proliferation.

**GOLGI APPARATUS** 

1962

jellyfish,

Prize 2008)

Osamu Shimomura

### describes GFP isolated from 1955-56

Christian de Duve A. victoria (Nobel

HIGHLIGHTS OF CELL BIOLOGY AND MICROSCOPY

# 1852

George Stokes describes wavelength change between fluorescent absorption and emission (Stokes shift)

1873 Ernst Abbe describes resolution limit for

light microscopes

1933 Ernst Ruska develops first electron microscope (Nobel Prize 1986)

and peroxisome vesicles; George

Palade describes ribosomes on endoplasmic reticulum (Nobel Prize 1974)

describes lysosome

1665 Robert Hooke coins the term "cell"

1595-1610 The first compoun microscopes made

1833 Robert Brown describes the cell nucleus

1838-39 Matthias Schleiden and Theodor Schwanr formulate "cell theory

1673

Antonie van

microscope

Leeuwenhoek manufactures single lens

> 1890 mitochondria) in muscle of beetle D. marginalis

Camillo Golgi 1891 describes internal reticular apparatus **Paul Ehrlich** later known as the describes Golgi apparatus antibodies (Nobel Prize 1906)

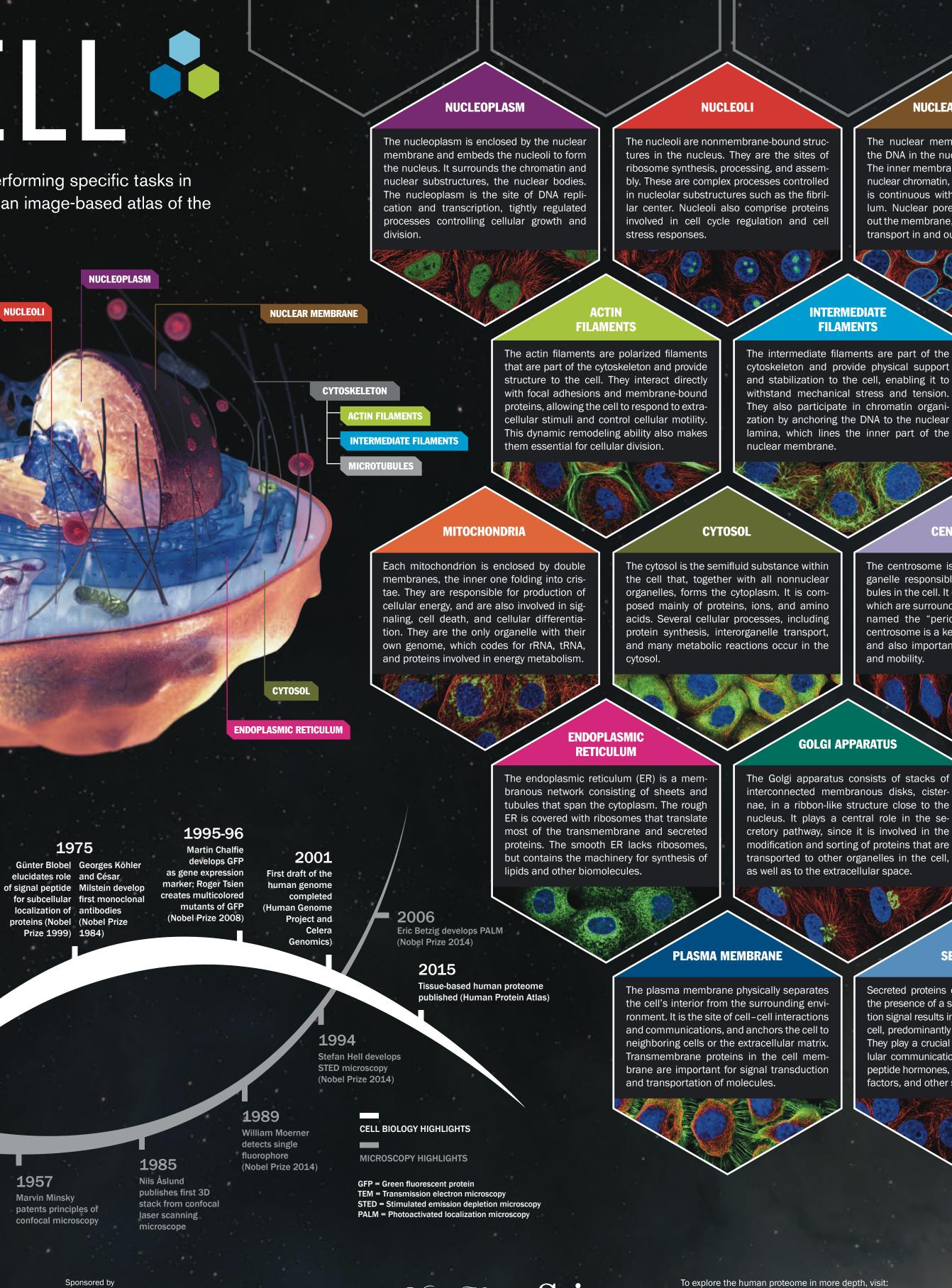
Nobel Prize

1908)

lbert Coon is first to use 1898 antibodies coupled to fluorescent molecules

1945 Keith Porter Albert Claude 1941 and Ernest ullam describe organization of cell using TEM A. Claude Nobel Prize 1974)

1935 Frits Zernike develops phase contrast microscopy (Nobel Prize 1953)



THE HUMAN PROTEIN ATLAS 💑

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### NUCLEAR MEMBRAN

The nuclear membrane physically isolates the DNA in the nucleus from the cytoplasm The inner membrane is the anchoring site of nuclear chromatin, while the outer membrane is continuous with the endoplasmic reticu lum. Nuclear pores are scattered throughout the membrane, regulating large molecule transport in and out of the nucleus

The microtubules are the stiffest of the cytoskeleton components and are essential for maintaining the internal architecture and polarity of the cell. They are involved in spindle formation during mitosis, and also form a network facilitating intracellular transport. Cell motility requires rapid rearrange ment of microtubules.

ICROTUBULES

### CENTROSOM

The centrosome is a small and distinct organelle responsible for organizing microtubules in the cell. It consists of two centrioles, which are surrounded by a matrix of proteins named the "pericentriolar material." The centrosome is a key regulator of cell division and also important for cell shape, polarity, and mobility

The small membrane-bound organelles, known collectively as vesicles, include endosomes, lysosomes, peroxisomes, lipid droplets and transport vesicles including secretory granules. The diversity of vesicles is reflected in their plethora of functions, such a specialized metabolic reactions, transport secretion, and degradation of biomolecules

VESICLES

### **SECRETED**

Secreted proteins can often be identified by the presence of a signal peptide. This localization signal results in active transport out of the cell, predominantly via the secretory pathway They play a crucial role for inter- and intracel lular communication and include antibodies peptide hormones, coagulation factors, growth factors, and other signaling molecules.



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