



Paris, 7 April 2014

How do our cells grow?

Some cells in our bodies need to increase their surface area significantly in order to perform their functions. This is particularly true of neurons, whose cell membrane surface area increases by 20% every day during development. When neurons reach maturity, their membrane surface area is 250,000 μm^2 , totalling 25000 m^2 when all the neurons in the brain are considered. Starting at only $\sim 1256 \mu\text{m}^2$, the total surface area of the ensemble of brain neurons thus increases 200 times, eventually covering an area equivalent to 4 football fields.

In a study published in [Nature Cell Biology](#), Thierry Galli, director of research at Inserm and his colleagues¹ reveal a new mechanism involved in cell membrane growth.

We already knew that secretory vesicles add membrane to the existing cell membrane, making it grow. This occurs through fusion of the vesicles with the cell membrane and involves special proteins known as SNARE proteins whose discovery earned Thomas Südhof, James E Rothman and Randy Schekman the Nobel Prize in Physiology or Medicine in 2013.

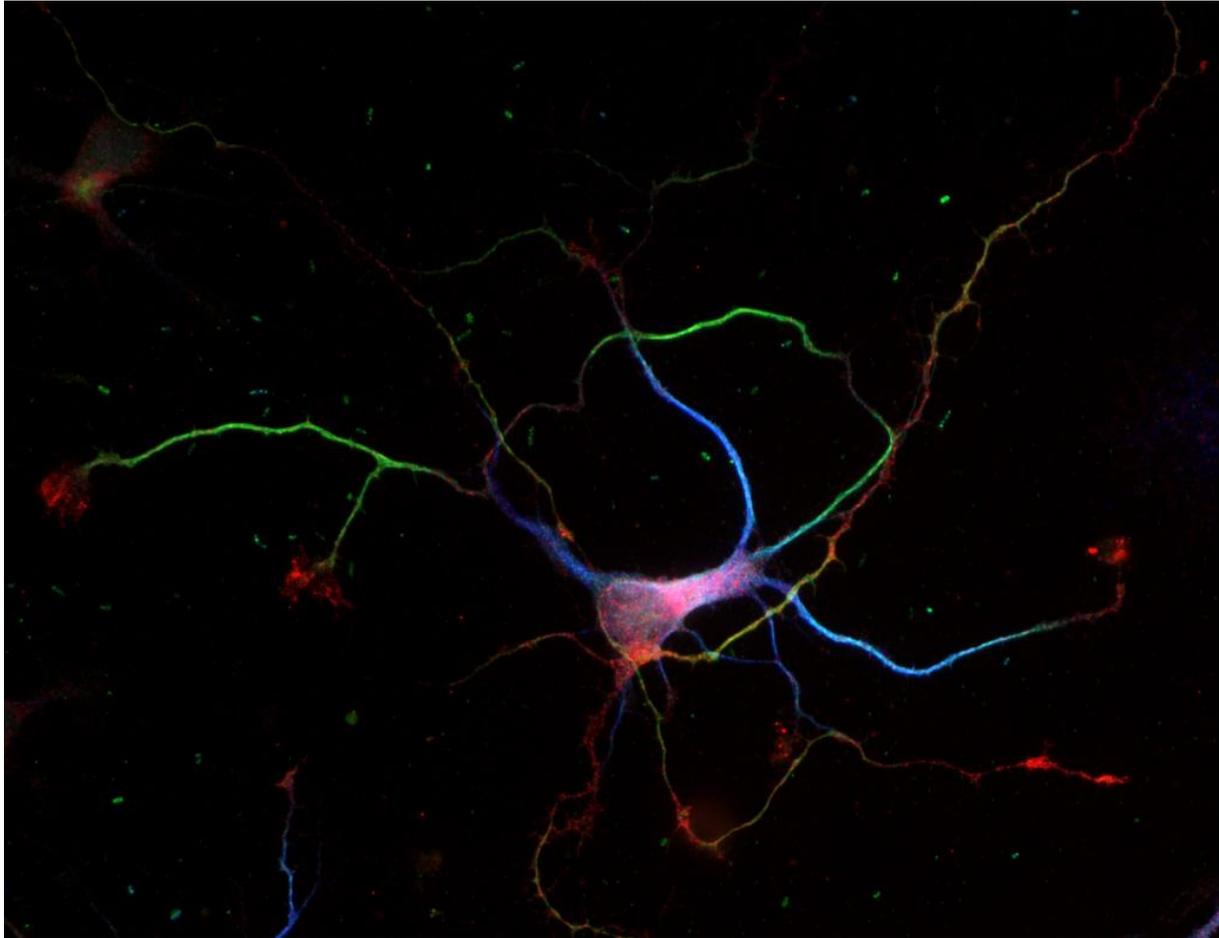
The Inserm research team looked at SNARE proteins in mice that were especially abundant at the ends of growing neurons or axons. The researchers identified a specific protein, 'Sec 22', first discovered in yeast by Randy Schekman.

"It emerged that the protein 'Sec22' plays an active role in cell growth by forming bridges within cells which appear to transport the material needed for their membranes to grow" explains Thierry Galli Inserm Director of Research.

These SNARE bridges between the endoplasmatic reticulum and the plasma membrane, which do not mediate membrane fusion, appear instead to help synthesised lipids pass directly from the endoplasmatic reticulum to the cell surface.

"It is entirely possible that this new mechanism for cell growth is prevalent in rapidly-dividing cells such as cancer cells." he concludes.

¹ Inserm Research Team Unit 950 "Normal and pathological membrane traffic" (Inserm/CNRS/Paris Diderot University) in collaboration with the "Membrane dynamics and intracellular traffic" team (CNRS/Paris Diderot University; Cathy Jackson and Jean-Marc Verbavatz), the "Cellular biology of the synapse" team (Inserm/CNRS/ENS; Antoine Triller) and Xavier Darzacq, Institut de Biologie de l'École Normale Supérieure (IBENS), "Imaging of transcriptional machinery" team



Special types of vesicular transport in rat hippocampal neurons after 3 days' growth (SNARE proteins in red).

© Inserm/Burgo, Andrea

Sources

The SNARE Sec22b has a non-fusogenic function in plasma membrane expansion

Maja Petkovic^{1,2,3,10}, Aymen Jemaiel^{1,4,9}, Frédéric Daste^{1,2,9}, Christian G. Specht⁵, Ignacio Izeddin⁶, Daniela Vorkel⁷, Jean-Marc Verbavatz⁷, Xavier Darzacq⁶, Antoine Triller⁵, Karl H. Pfenninger⁸, David Taresté^{1,2}, Catherine L. Jackson^{1,4}, Thierry Galli^{1,2}

1 Institut Jacques Monod, UMR 7592, CNRS, Univ Paris Diderot, Sorbonne Paris Cité, F-75013 Paris, France

2 INSERM ERL U950, 'Membrane Traffic in Neuronal & Epithelial Morphogenesis', F-75013 Paris, France

3 Ecole des Neurosciences de Paris (ENP), Paris, France

4 Membrane Dynamics and Intracellular Trafficking, Institute Jacques Monod, Paris, France

5 Cellular Biology of the Synapse, Institut de Biologie de l'Ecole Normale Supérieure (IBENS), INSERM

U1024, 75005 Paris, France

6 Functional Imaging of Transcription, Institut de Biologie de l'Ecole Normale Supérieure (IBENS), INSERM

U1024, 75005 Paris, France

7 Max Planck Institute of Molecular Cell Biology and Genetics, 01307 Dresden, Germany

8 Colorado Intellectual and Developmental Disabilities Research Center (IDDRC), Denver, USA

9 equal contributions

10 present affiliation: Howard Hughes Medical Institute, Departments of Physiology, Biochemistry, and Biophysics, University of California, San Francisco, San Francisco, CA 94158, USA

Research contact

Thierry Galli

Inserm Research Director

Director of the team "Membrane traffic in health and disease" (Inserm/CNRS/Paris Diderot University)

Assistant director of the Thematic Institute of "Cellular biology, development and evolution"

thierry.galli@inserm.fr

+33 (0)1 57 27 80 39



© Inserm/Hirsch, Philippe

Press contact

Juliette Hardy / presse@inserm.fr