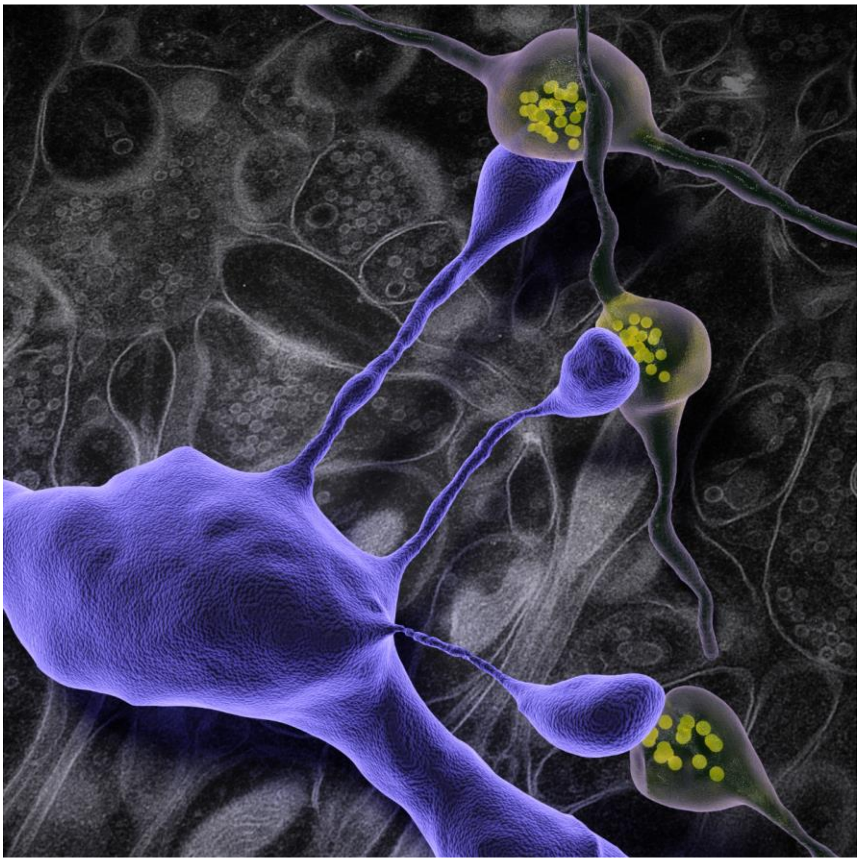
News Release

Title

Rapid freezing reveals truer structure of brain connections

Key Points

- A snap freezing method of liquid nitrogen jets, combined with very high pressures, preserve small pieces of brain tissue, such as dendritic spines with significantly thinner necks.
- This work highlights the usefulness of rapid freezing methods and electron microscopy for obtaining a more detailed view of the architecture of cells and tissues.



Summary

Scientists from the EPFL's School of Life Sciences have now used a snap freezing method of liquid nitrogen jets, combined with very high pressures, to instantaneously preserve small pieces of brain tissue. The researchers from the labs of Professors Graham Knott and Carl Petersen then used high-resolution, 3D, imaging with electron microscopes to reveal how the true dendritic spine structure was not too dissimilar from that which had been shown previously, except in one important aspect. The instant freezing method showed dendritic spines with significantly thinner necks. This result validates a considerable body of theoretical, as well as functional data, going back many years, showing that dendritic spines are chemical, as well as electrical, compartments isolated from the rest of the neuron by a thin and high resistance neck. Variations in the neck

diameter will have important consequences for the influence of a synapse on the rest of the neuron.

Research Background

Most of the synaptic connections in the adult brain are situated on small stalk-like protrusions of about one micrometer in length that extend from the neurons' surface. These are called dendritic spines, and their exact size and shape determine how well signals are passed from one neuron to another. These details are important for modeling brain circuits and also for understanding how information is transmitted between neurons, across the brain's neuronal circuits. However, their small size and the difficulties in preserving brain tissue in its natural state have always left the question open as to what the true structure of the dendritic spine is.

Future Perspective

As well as revealing the true shape of these important brain structures, this work highlights the usefulness of rapid freezing methods and electron microscopy for obtaining a more detailed view of the architecture of cells and tissues.

Publication

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Ultrastructural comparison of dendritic spine morphology preserved with cryo and chemical fixation.

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