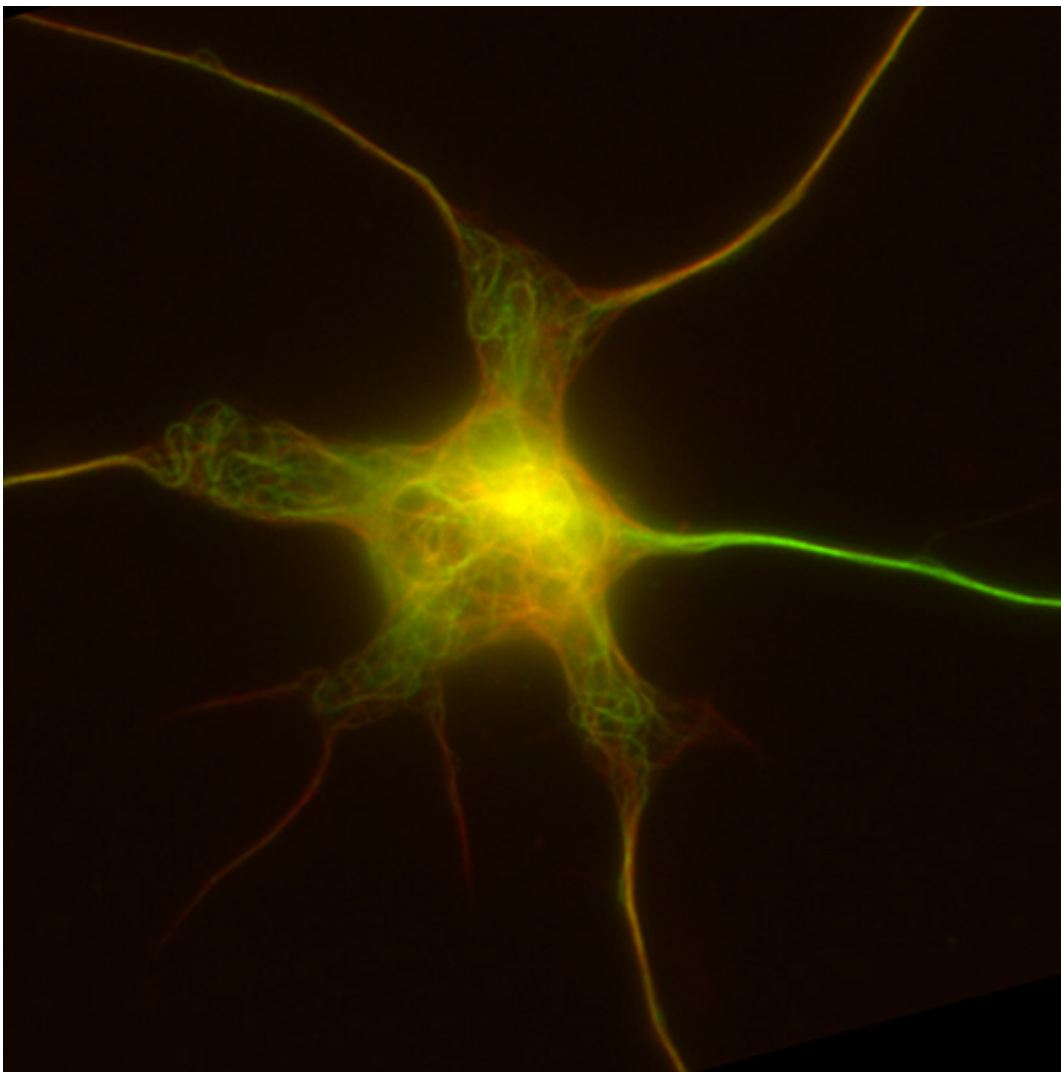


Researchers discover the machinery that neurons use to form and maintain their neuronal extensions

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Microscopy image of a culture mouse neuron showing the microtubule network in green and red depending on chemical modifications. The axon, in bright

green, is the neuronal extension that has the greatest number of modified microtubules . Credit: Carlos Sánchez-Huertas, IRB Barcelona

Scientists at the Institute for Research in Biomedicine (IRB Barcelona), headed by Jens Lüders, group leader of the Microtubule Organization Laboratory, have described a new molecular mechanism that plays a key role in forming and maintaining axons. Their work appears in *Nature Communications*.

Neurons send a constant flow of substances and signals along axons, which are neuronal extensions that in humans can reach lengths of up to one meter. Inside axons is a dense network of microtubules, thin filaments that drive the growth of the axon, and at the same time serve as transport channels for cellular components.

"Neurons are cells that are especially dependent on microtubules, not only to transport internal [cellular components](#), but also to facilitate communication between themselves. Curiously, until now we haven't known how these microtubules are formed and organized," says Jens Lüders.

Repurposing of a molecular complex used in cell division

Studying hippocampi in mice, the researchers observed that differentiated [neurons](#) – those that had lost the ability to divide – use a molecular complex that until now has only been known to play a role in [cell division](#) to generate new microtubules within their axons.

"This complex plays a determining role in the formation and maintenance of the neuronal axon, one of the most enigmatic cellular

structures," comments the first author of the study Carlos Sánchez-Huertas, postdoctoral researcher in Lüders group at IRB Barcelona and currently at the Centre de Recherche de Biologie Cellulaire (CNRS) in Montpellier. "I believe scientists will discover more cases of cell division proteins being re-used by post-mitotic cells for other molecular activities."

The scientists propose that in neurons, the complexes formed by Augmin and γ -Tubulin (γ TuRC) promote the formation of new microtubules along already existent ones. The new microtubule 'inherits' the same orientation as the previous one, leading to the formation of bundles of microtubules with the same polarity, which is a fundamental characteristic of axons.

Understanding how microtubules form and how they are organized in a complex and structured network within neurons is key to making advances in neuroscience. These processes can offer insight into the regeneration of axons, a step that is necessary for medullar lesion repair, but which still remains to be achieved. The study also may provide insight into neurodegenerative diseases, such as Alzheimer's, in which the microtubule network is damaged.

More information: Carlos Sánchez-Huertas et al. Non-centrosomal nucleation mediated by augmin organizes microtubules in post-mitotic neurons and controls axonal microtubule polarity, *Nature Communications* (2016). [DOI: 10.1038/ncomms12187](https://doi.org/10.1038/ncomms12187)

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