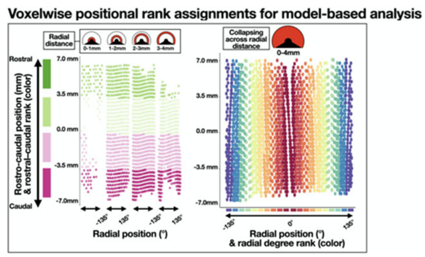
This Week in The Journal

PAG Responses in a Nonthreatening Task

Alexandra Fischbach, Ajay Satpute, Karen Quigley, Philip Kragel, Danlei Chen et al.

(see article e1757232024)

The role of the periaqueductal gray (PAG) in human and animal responses to threats has received much research attention. While there is growing support for the PAG also playing a role in regulating bodily functions related to nonthreatening stimuli, direct evidence for this is lacking. With a sample size of nearly 90 people, Fischbach et al. examined whole brain and PAG subregion responses using ultrahigh field 7-Tesla functional magnetic resonance imaging during a minimally threatening visual N-back working memory task. Whole brain responses were spatially similar for both mildly and moderately difficult cognitive tasks. The authors discovered that the ventrolateral PAG, which is functionally linked to the anticipation of painful threats, clearly responded to both mild and moderate cognitive demands in the task. This study challenges the idea that the PAG controls survival behaviors alone, suggesting that it contributes to more general brain–body functions.



PAG topography in one-back and three-back conditions was modeled by assigning ordinal ranks to voxels according to their position on the rostral–caudal axis and radial degree. The voxels were averaged for each subject to produce estimates for mixed-effects models. See Fischbach et al. for more details.

Identifying a New Variable for Action Potential Propagation Down Myelinated Axons

Nooshin Abdollahi and Steven Prescott

(see article e0569242024)

Neural processing owes its speed and efficiency to myelinated axons, which enable action potentials to jump between nodes of Ranvier over long distances. The velocity at which action potentials travel from node to node is strongly associated with characteristics of myelinated axons, such as axon diameter and myelin thickness. In this issue, Abdollahi and Prescott used computational simulations to suggest that another variable is involved: extracellular conditions. They simulated different extracellular current flows in the spaces around the axon membrane and outside the myelin to demonstrate that conventional models (in which extracellular space is connected to ground) transmit less axial current and are therefore less energy efficient than models in which the extracellular space is more resistive. More resistive extracellular boundary conditions significantly increase the velocity and energy efficiency of action potential propagation. The authors' consideration of extracellular conductance determined by myelin layers, the space around these layers, and the crowding of axonal fibers is unprecedented. These findings point to extracellular conditions as an oversight in our understanding of action potential propagation down myelinated axons and may have broad implications for neuroscience.

This Week in The Journal was written by Paige McKeon

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