Channel Subunits Are Heterogeneously Expressed in the AIS
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An action potential’s threshold and shape are governed by the distribution and subunit composition of voltage-gated sodium and potassium channels in the axon. To learn how differences in subunit expression might contribute to the exact site of action potential initiation, Lorincz and Nusser examined the distribution of four potassium and sodium channel subunits (Nav1.1, Nav1.6, Kv1.1, and Kv1.2) in the axon initial segment (AIS) of neurons in several regions of adult rat brain. The expression pattern was surprisingly heterogeneous across cell types and brain regions. For example, only inhibitory interneurons expressed Nav1.1, and in some neurons, it was expressed along the entire AIS, whereas in others it was restricted to the proximal AIS. Likewise, expression of other subunits was uniform or graded depending on cell type. In Purkinje cells—in which action potential generation occurs in the first node of Ranvier rather than the AIS—neither potassium channel subunit was expressed in the AIS.

Behavioral/Systems/Cognitive
BOLD Signals Do Not Always Reflect Neural Activity
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Each year, thousands of publications present functional magnetic resonance imaging (fMRI) data that suggest that a particular brain region is active during a particular cognitive task. Casual readers of such papers might forget that this technique does not actually measure neural activity, but rather blood oxygenation level-dependent (BOLD) contrasts. Synaptic transmission requires large energy expenditures, and increased energy metabolism has been hypothesized to act directly on blood vessels to increase blood flow and alter BOLD signals. This week, however, Devor et al. report that this hypothesis is not always correct. As expected, stimulating the forepaw of rats increased blood oxygenation, vessel diameter, glucose uptake, spiking, and synaptic release in the contralateral primary somatosensory cortex. In the ipsilateral cortex, however, neural activity and glucose uptake increased, but blood oxygenation and blood flow did not. These results indicate that blood flow is not directly tied to metabolism, and BOLD signals do not always reflect neural activity.