Uncooperative voltage sensors: Study advances conclusions about the Shaker Kv channel

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The May 2009 issue of the *Journal of General Physiology* features an article and accompanying commentary on new experimental evidence that advances previous conclusions about the essential features of the Shaker K+ channel, a voltage-gated potassium (Kv) channel.

As Richard Horn (Department of Molecular Physiology and Biophysics, Institute of Hyperexcitability, Jefferson Medical College) explains in his *JGP* commentary:

"Many of the essential features of the voltage-sensing mechanism are known … [including consensus that], as in the original Hodgkin-Huxley model (Hodgkin and Huxley, 1952), all four of the channel's S4 [fourth transmembrane] segments must be in an activated conformation at a depolarized voltage before the channel can open. Part of the evidence for this assertion is that preventing the outward movement of only one S4 segment, by photocrosslinking it to a neighboring region, prevents Shaker 's activation gate from opening (Horn et al., 2000). Therefore, channel opening requires the participation of all four voltage sensors. This conclusion is furthered advanced by an article in this issue by Gagnon and Bezanilla (2009). These authors propose, and provide evidence, that if three of the voltage sensors in a channel are in a permanently activated conformation, the fourth voltage sensor can open and close the channel by itself."

In his conclusion, Horn explains that the technique employed by Gagnon and Bezanilla, in addition to other recent complementary techniques, "promises to unmask some of the previously inscrutable features of the allosteric communication among entwined Kv subunits and between the homologous domains of sodium channels."

More information:

Gagnon, D.G., and F. Bezanilla. 2009. J. Gen. Physiol. doi: 10.1085/jgp.200810082.
Hodgkin, A.L., and A.F. Huxley. 1952 . J. Physiol. 117:500.
Horn, R., S. Ding, and H.J. Gruber. 2000. J. Gen. Physiol. 116 : 461 - 475 .
Horn. R. 2009. J. Physiol. doi: 10.1085/jgp.200910236.

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