

The Description of Additional Supplementary Files

Supplementary Movie 1: Morph between two structural states of xKCNQ1-CaM illustrating conformational changes in the VSD. A morph was generated in Chimera to visualize the transition from the activated (xWT) state to the intermediate state (xE1R/R2E) and back, highlighting conformational differences in the VSD. Adjacent xKCNQ1 subunits are colored in different shades of green and CaM is colored yellow. Side and top views are shown.

Supplementary Movie 2: Morph between xWT and xE1R/R2E focused on the position of the charges in the S4 with respect to the CTC. Adjacent xKCNQ1 subunits are colored in different shades of green. The S5 from the adjacent subunit (S5') is shown to facilitate orientation. The CTC residues (Xenopus; E160 (E2), xF157 (F0), and xD192 (D3), and Human; hE170, hF167, hD202) and the relative position of the S4 residues xR218 (R1), xR221E (R2E), xQ224 (Q3), xR227 (R4), xH230 (H5), and xR233 (R6) (human equivalents; R228, R231E, Q234, R237, H240, and R243) are shown. C α atoms are highlighted as yellow spheres, backbones are shown as tubes and helices S1 and S3 were removed for clarity. D3 from the S3 helix is shown in stick format.

Supplementary Movie 3: Top view morph of one VSD to visualize the loss of interactions with the FH from the adjacent subunit (FH') going from the activated to the intermediate state. Occupancy of the intermediate state in the charge-reversal mutant (xE1R/R2E) results in fewer interactions between the rest of the VSD and residues in the S1 and S2 helices, as well as setting them away from the FH'. Adjacent xKCNQ1 subunits are colored in different shades of green. Residues interacting with 221 and 150 are shown as gray and yellow sticks, respectively. Salt-bridge interaction in xWT is shown as a black line, polar interactions as blue dashed lines and the potential salt-bridge interaction in the xE1R/R2E structure as black dashed line.