PNAS Plus Significance Statements

Energy systems transformation

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Energy systems based on fossil fuels and uranium have brought about modernity and its specific agro-industrial metabolism. Although this achievement creates a deep lock-in effect, collateral damages such as climate change and large-scale contamination cast doubts on the sustainability of the current mode of global socio-economic operation. This article (pp. E549–E558) analyzes why the incumbent energy systems are so rigid and still outcompete their more sustainable rivals. We elucidate the role of contemporary corporate law in this context and argue that the stiffness of current energy systems could be overcome by assigning unlimited responsibilities to shareholders.

I_{Ks} channels open slowly because KCNE1 accessory subunits slow the movement of S4 voltage sensors in KCNQ1 pore-forming subunits

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E1 and Q1 protein subunits assemble to form I_{Kslow} channels in the heart and ear. Inherited mutations in either subunit that decrease protein level or alter function can cause life-threatening cardiac arrhythmias and deafness. The mechanism by which E1 slows channel opening has been the subject of active debate. Here (pp. E559–E566), we use gating current measurements and simultaneous recordings of ionic currents and changes in fluorescence of a probe on the Q1 voltage sensors to demonstrate that E1 slows the movement of sensors in a manner that is both necessary and sufficient to determine the slow activation time course of I_{Ks} channels.

Stick-slip friction and wear of articular joints

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The goal of this study was to use the Surface Forces Apparatus to examine the effects of slip-stick friction on cartilage surface morphology under different loading and sliding conditions. Different load and speed regimes were represented using friction maps that separated regimes of smooth and stick-slip sliding. The finding of this work (pp. E567–E574) is that damage generally occurs within the stick-slip regimes and is not directly related to the friction coefficient. Prolonged exposure of cartilage surfaces to stick-slip sliding resulted in a significant increase of surface roughness, indicative of severe morphological changes (damage) of the cartilage surfaces.

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