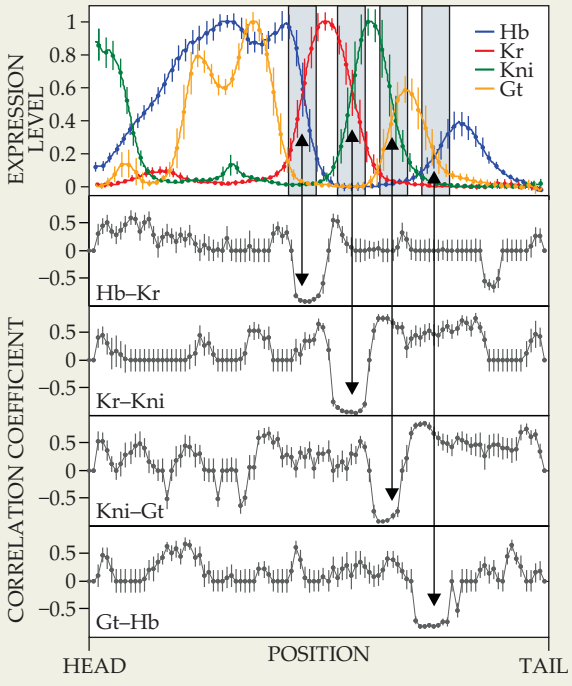

Figure 2. Four main gap genes—giant (Gt), hunchback (Hb), knirps (Kni), and Krüppel (Kr)—create a characteristic expression pattern in developing fruit-fly embryos. In each of the four shaded regions in the top panel, the two active genes exhibit strong anticorrelations, one sign of a network tuned to a critical point. (Adapted from ref. 2.)

in the top panel of figure 2—where just two of the genes have significant expression levels, and the network dynamics are simplified. "Even so," explains Bialek, "one has to make some perhaps arbitrary choices about the kinds of models one wants to consider." He and Krotov looked at several possibilities and found that in each case, the model parameters that best fit the data were close to a critical point. "Although we started with specific models, we realized that we could say things in a much more general language. We'll probably get back to the detailed models at some point."

Strong local anticorrelations are a universal feature of a two-gene network at criticality, and indeed, in each of the shaded regions of figure 2, the correlation coefficient between the two active genes approaches −1. Bialek and Krotov identified several other signatures of a two-gene network tuned to a critical point—including slow dynamics, long-range spatial correlations, and non-Gaussian distributions of fluctuations—and found that the gap-gene network exhibits all of them.

Still, they don't regard their observations as airtight proof that the network is operating at a critical point, because each of the signatures could also arise in other ways. And the implications of criticality (or of a network that mimics one at criticality) are still far from clear. Critical points constitute a small and distinctive region of parameter space, and the odds that a genetic network would find itself near a critical point by chance, from network parameters chosen at random, are small. Then again, life itself occupies a small and distinctive region of parameter space: As Bialek explains, "Most of the ways we can imagine putting molecules in a small box together don't result in the system organizing itself and walking out of the lab." Looking further into the question of how and why evolution would guide a system toward critical behavior could, he argues, lead to new insights into what is so special about life. "We take some stabs at this question," he says, "but we're still very much in the dark."

Johanna Miller

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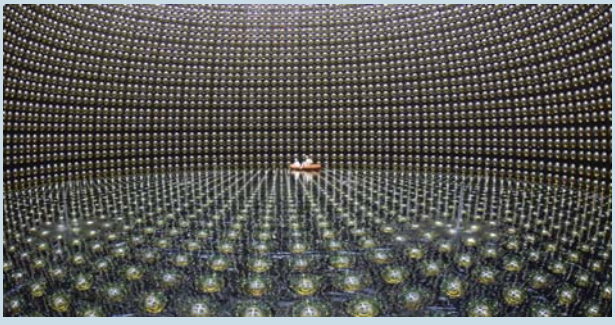

effect of matter on neutrino identity has now been directly observed by the enormous Super-Kamiokande neutrino detector in Japan (see the figure). The Super-K experiment is conceptually simple: Experimenters compare the flux of solar electron neutrinos observed during the day and night. The neutrinos detected after sunset must have passed through Earth to reach the detector, so a day–night flux differential confirms flavor changes induced via matter interactions. The 3% enhancement in electron-neutrino flux observed during the evening hours—a 2.7-sigma effect—is in accord with theoretical expectations based on well-established vacuum-oscillation parameters. (A. Renshaw et al., Super-Kamiokande collaboration, *Phys. Rev. Lett.* **112**, 091805, 2014; figure courtesy of Super-Kamiokande.) —SKB

Mimicking microcapillaries. Thanks to microscopes and high-speed video cameras, it's possible to follow the flow of red blood cells (RBCs) through the 10-μm-diameter capillaries that service mammalian cells. It's also possible to follow RBCs through 10-μm-diameter glass tubes—which is how researchers discovered that under outwardly similar conditions, the flow of RBCs is significantly slower *in vivo* than *in vitro*. The forest of molecules—mainly protein–sugar hybrids—that sprouts from the inner surface of capillaries and known collectively as the endothelial glycocalyx is suspected as the discrepancy's principal source. That attribution is now on firmer experimental ground. Giovanna Tomaiuolo of the University of Naples in Italy and her colleagues have mimicked the effect of the endothelial glycocalyx by using methacrylate polymer chains. When RBCs are sent through polymer-lined microcapillaries, they conceivably encounter two sources of resistance. The first is the restriction of the channel's diameter by the polymer layer. The second source is the increased dissipation that results when RBCs pass by the chains and cause them to jiggle. It turned out that the second source is the more important: For the same surface density of chains, the reduction in RBC flow was independent of layer thickness. Tomaiuolo's results could help elucidate the pathology of diabetes, atherosclerosis, and other vascular diseases that entail alterations to the endothelial glycocalyx. (L. Lanotte et al., *Biomicrofluidics* **8**, 014104, 2014.) —CD