CLIMATE SCIENCE

The Way They Were

During much of the Eocene, from about 55 to 45 million years ago, vast conifer forests existed north of the Arctic Circle where no such vegetation exists today. Some paleobotanical studies have led to suggestions that the forests of eastern Asia are a good modern analog for those ancient woods, based on the similarity of tree types. However, more recent studies of environmental conditions such as mean annual precipitation and productivity in the Eocene have led others to conclude that the Arctic forests were more like those of the modern Pacific Northwest. Schubert *et al*. present reconstructions of the seasonality of paleoprecipitation, based on high-resolution intra-ring carbon isotope measurements of fossil wood, to show that the Eocene Arctic forests experienced around three times more precipitation during summer than during winter, unlike in the Pacific Northwest, where summer precipitation is much less abundant than winter precipitation. Therefore, the temperate forests of eastern Asia probably are the best modern analog for the Eocene Arctic forests. — HJS

Geology 10.1130/G32856.1 (2012).

BIOPHYSICS

Taking the Wrong Path

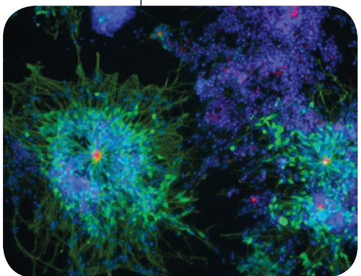
Most proteins fold efficiently into their functional native structures either on their own or with the help of a molecular chaperone. Despite quality-control pathways, however, misfolded proteins occur in the cell and are associated with a range of diseases such as Alzheimer's, Parkinson's, and prion disorders. Given the severe consequences of protein misfolding, there is much interest in understanding the mechanisms of misfolding for disease-associated proteins. In prion diseases, a misfolded form of the prion protein, PrP, aggregates and induces conversion of natively folded protein to the misfolded form. Yu *et al.* used single-molecule force spectroscopy to directly observe the misfolding of PrP. They observed two-state behavior with no evidence of an intermediate on the native folding pathway. Three non-native structures were accessed from the unfolded state, however. These misfolding pathways were explored more frequently than the native pathway, but the misfolded states were rarely occupied because of their instability. A mutant with higher aggregation propensity had a similar folding pathway as the native protein, but two of the misfolded states were more stable in the mutant, which suggests that these states may be involved in aggregation. Applying this approach to other misfolded proteins will give insight into commonalities and differences between misfolding mechanisms. — VV

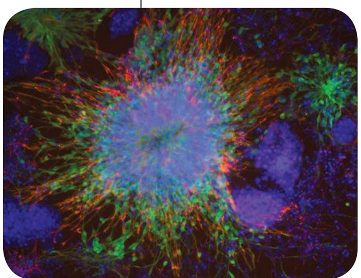
Proc. Natl. Acad. Sci. U.S.A. **109**, 5283 (2012).

NEUROSCIENCE

Evolving Function

Excessive expansion of a series of glutamine residues in the N terminus of the protein huntingtin (HTT) lies at the root of the neurodegenerative Huntington's disease. Although HTT is evolutionarily conserved, the number of glutamines the gene encodes is not. For example, HTT in the slime mold *Dictyostelium discoideum* has none of the susceptible glutamines; however, the sea urchin (*Strongylocentrotus purpuratus*) variant of HTT has two. In mammals, HTT has a larger and more expandable glutamine tract and is expressed in the developing brain, where it is known to regulate neural tube formation. How HTT specifically regulates neurulation, however, is not well understood. Lo Sardo *et al.* found that mouse embryonic stem cells deficient in HTT expression were also deficient in the intercellular adhesions needed to form neuroepithelial rosettes, hallmarks of neurulation in vitro. The authors tested the ability of N-terminal portions of HTT from other organisms to substitute for the mammalian HTT and found that HTT fragments from the evolutionarily distant *Dictyostelium* were the least effective. These results suggest a possible connection between the acquisition of a cell adhesion function during the evolution of the HTT protein and the evolution of more complex, centralized neural systems developed by the process of neurulation during embryogenesis. — PJH





Nat. Neurosci. **15**, 10.1038/nn.3080 (2012).

MATERIALS SCIENCE

Remote Heating

The high electronic conductivity of carbon nanotubes and graphene could be exploited for delivering power to electronic devices. However, even these good conductors can undergo resistive or Joule heating, and despite their good thermal conductivity, dissipating the heat from a device may prove problematic—interfaces with other materials appear to have high interfacial thermal resistance. Baloch *et al.* show that when current flowed through a multiwalled carbon nanotube on a substrate (a silicon nitride membrane), 84% of the heating occurred in the underlying substrate. This remote Joule heating was driven by the electrical current coupling to vibrational modes in the membrane. These conclusions are based on modeling of thermal profiles determined by following the melting of indium overlayers on these devices with transmission electron microscopy. — PDS

Nat. Nano. 10.1038/NNANO.2012.39 (2012).

CREDITS (TOP TO BOTTOM): ISTOCKPHOTO.COM; LO SARDO *ET AL. NAT. NEUROSCI.* 15, 10.1038/NN.3080 (2012)

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