Let there be a channel

A newly discovered rhodopsin does double duty as light detector and proton channel, say Georg Nagel (Max-Planck-Institut für Biophysik, Frankfurt am Main, Germany), Peter Hegemann (Universität Regensburg, Germany), and colleagues. Meanwhile, a group led by John Spudich at the University of Texas (Houston, TX) has used RNA interference to show that this and another channel are the two rhodopsins that the alga *Chlamydomonas reinhardtii* uses to determine whether to move closer to or further from a light source.

Previously, Hegemann has purified algal proteins that bind retinal, the light-detecting chromophore, but they turned out not to be the detector for phototaxis. His latest candidate, which was named channelrhodopsin-1 (Chop 1), came from a database search. The sequence is similar to that of bacteriorhodopsin, which passes protons from one residue to another thus acting as a pump. Although this network of residues is intact in Chop 1, some of these Chop 1 residues can be mutated without destroying proton conductance. Furthermore, Chop 1 produced in frog oocytes cannot move protons against a gradient, as with the pump bacteriorhodopsin, but acts like a channel that allows diffusion in either direction.

The researchers are not surprised by the two-in-one protein, as the speed with which *Chlamydomonas* reacts to light had suggested a direct connection between light detection and ion conductance. Now, they want to understand how a pump like bacteriorhodopsin can be modified to make a channel that may be gated by retinal.

References: Nagel, G., et al. 2002. Science. 296:2395–2398; Sineshchekov, O.A., et al. 2002. Proc. Natl. Acad. Sci. USA. 99:8689–8694.

Condensin wraps it up

Packing DNA into a nucleus is no mean feat. Now, David Bazett-Jones (Hospital for Sick Children, Toronto, Canada), Keiji Kimura, and Tatsuya Hirano (Cold Spring Harbor Laboratory, Cold Spring Harbor, NY) have found that a single condensin complex can use ATP to wrap two positive gyres of DNA around itself. That packaging, however, may just be the start.

Based on previous experiments, Hirano and colleagues had suggested that an individual condensin might span a considerable distance between DNA binding sites and introduce global writhes that would twist the DNA into a right-handed solenoid. But direct observation of single complexes on naked DNA by electron spectroscopic imaging has now shown that a single complex is instead tightly wrapped with two turns of DNA.

What that means for condensation of cellular chromatin is not yet clear. “We don’t think that the local wrapping per se would account for the massive compaction of chromatin,” says Hirano. There are several models that could explain additional compaction. A single condensin could bring two distantly located DNA segments together, although Hirano has no evidence for such a mechanism. A similar outcome could be achieved if multiple condensins bind to each other, or condensin may wind already compacted DNA around its core.

In future experiments, Hirano plans to study the in vitro reaction of condensin with chromatin rather than naked DNA. For now, he favors an old model in which the real function of condensin’s wrapping of DNA is the introduction of compensatory negative supercoils in the surrounding DNA. Such superhelical tension might in turn act as a driving force in coiling up a chromatin fiber.

Reference: Bazett-Jones, D.P., et al. 2002. Mol. Cell. 9:1183–1190.

Attack of the waves

A. W. Wells/NAS

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Reference: Kindzelskii, A.L., et al. 2002. Proc. Natl. Acad. Sci. USA. 10.1073/pnas.132630999.