

Oral presentation

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Forget cooperativity! – single-molecule signalling with cGMP

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We have characterized two novel cyclic nucleotide-gated (CNG) ion channels that are distinctively different from classic vertebrate CNG channels. One channel is from the bacterium *M. loti* and the other from sperm of sea urchins. Two conspicuous features that set apart these channels from known CNG channels: [1] an exquisite ligand sensitivity and [2] the lack of cooperative activation. In my talk, I'll show that binding of a single cGMP molecule is sufficient to open these channels. The exquisite sensitivity of the sea urchin CNGK channel endows sperm with the ability to register a single molecule of chemoattractant during chemotaxis and to generate a brief Ca²⁺ signal. During evolution two different classes of CNG channels evolved. One class is designed to operate at "high" ligand concentrations (μ M range); the other class is suitable to faithfully track ligand concentrations in the nanomolar range. At these low concentrations, the probability is miniscule that several cGMP or cAMP molecules simultaneously bind to the same channel. Therefore, a cooperative binding mechanism would impair sensitivity rather than enhance it.

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