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EVOLUTION

Planting genes

Ferns acquired the chimeric photoreceptor neochrome from hornworts by horizontal gene transfer, according to a new study. Neochrome consists of red-light-sensing phytochrome domains fused to blue-light-sensing phototropin domains. Whereas most plants only respond to blue light, the ability to additionally sense red light is thought to enhance phototropic responses. "This chimeric photoreceptor — once thought to be unique to ferns — allowed ferns to 'see better' under the low-light forest canopies," explains Fay-Wei Li, lead author of the study.

The researchers used data from the 1000 Plants Initiative to search for the evolutionary origin of neochrome. Surprisingly, they found homologues of neochrome in hornworts — a group of bryophytes that are closely related to mosses. A phylogenetic analysis of phytochrome and phototropin placed fern neochromes within the hornwort neochromes, which indicates that neochrome was transferred from hornworts to ferns and did not evolve independently. In addition, molecular dating points to neochrome entering the fern genome ~180 million years ago, which is far more recent than the divergence of ferns and hornworts (estimated to have occurred more than 400 million years ago). This is consistent with horizontal gene transfer rather than an ancient origin of neochrome followed by its loss in other lineages.

The authors propose that the acquisition of this gene enabled ferns to thrive and diversify in the shaded environment under the angiosperm canopy. "This is an exciting discovery because neochrome appears to have facilitated the fern radiation, suggesting that plant-to-plant gene transfer could have important evolutionary impacts," concludes Li.

Bryony Jones

ORIGINAL RESEARCH PAPER Li, F.-W. *et al.* Horizontal transfer of an adaptive chimeric photoreceptor from bryophytes to ferns. *Proc. Natl Acad. Sci. USA* http://dx.doi.org/10.1073/pnas.1319929111 (2014)

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