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Aureochrome, the blue light-activated transcription factor, is conserved in Stramenopile algae

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We discovered a new type blue light (BL) receptor in *Vaucheria* (Xanthophyceae) and other Stramenopile algae. By BLAST search we also found several orthologs in diatom genomes. We thus named this photoreceptor Aureochrome. Aureochrome has two functional domains, one bZIP- and one LOV domain. We confirmed with *Vaucheria* that at least one of the homologous proteins, Aureochrome1 (AUREO1), is functioning as a BL-activated transcription regulator. 1) Upon BL irradiation AUREO1 binds an FMN molecule and forms a cysteinyl photoadduct, although the chromophore is released in subsequent darkness with half-time of 5 min. 2) BL also induces a transient binding of AUREO1 to special DNA sequence, TGACGT. 3) RNAi experiment demonstrates that AUREO1 and AUREO2 are the photoreceptors for the BL-induced branching in *Vaucheria*, a photocyto-morphogenesis found in 1975. RNAi of AUREO2 unexpectedly induces many sex organ primordia, implicating AUREO2 as a suppressor of sexual reproduction. However, Aureochrome does not mediate chloroplast photoaccumulation. We are isolating the pair of Aureochromes, AUREO1 and AUREO2, in *Vaucheria* (Xanthophyceae), *Fucus* (Phaeophyceae), *Ochromonas* (Chrysophyceae) and diatoms. However, non-photosynthetic Stramenopile, such as oomycetes, do not have Aureochrome. It is also absent in Cryptophytes, Haptophytes and green plants. In contrast, Stramenopiles do not possess phototropin, which is commonly conserved in green plants. AUREOs may thus play essential roles in the life cycles of Stramenopile algae. Aureochrome can be used as a molecular switch to regulate the expression of desired gene. A part of this study was published in PNAS (2007).