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A Trait Lost for Millions of Years: Investigating the Loss of Root Hairs in Duckweed

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Changes in morphology have occurred frequently over the course of plant evolution, and in some cases involve the loss of entire organs or structures, yet the mechanisms that underpin organ loss are not well understood. We are using duckweed as a model to understand organ loss. As duckweed evolved, they experienced a dramatic reduction in anatomical complexity. Their roots losing the ability to take up nutrients, branch, and produce root hairs. In some species roots are lost entirely. This project aims to provide knowledge on how structures and traits and the networks which encode them are lost or reduced over time.

Using a combination of bioinformatics, molecular genetics, and tissue culture techniques, we aim to identify genes regulating root hairs that are missing in duckweed and then reintroduce homologs from related species using transgenic approaches. This project will give insights the complex genetic pathways that determine plant organ loss and evolution. Additionally, reintroducing genes that complete a hypothesised ancestral genetic pathway, will precede further synthetic biology projects, which aim to transfer complex genetic networks between organisms and unlock the benefits of ancestral genomes. This, all while firmly cementing duckweed as a plant of the future.

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