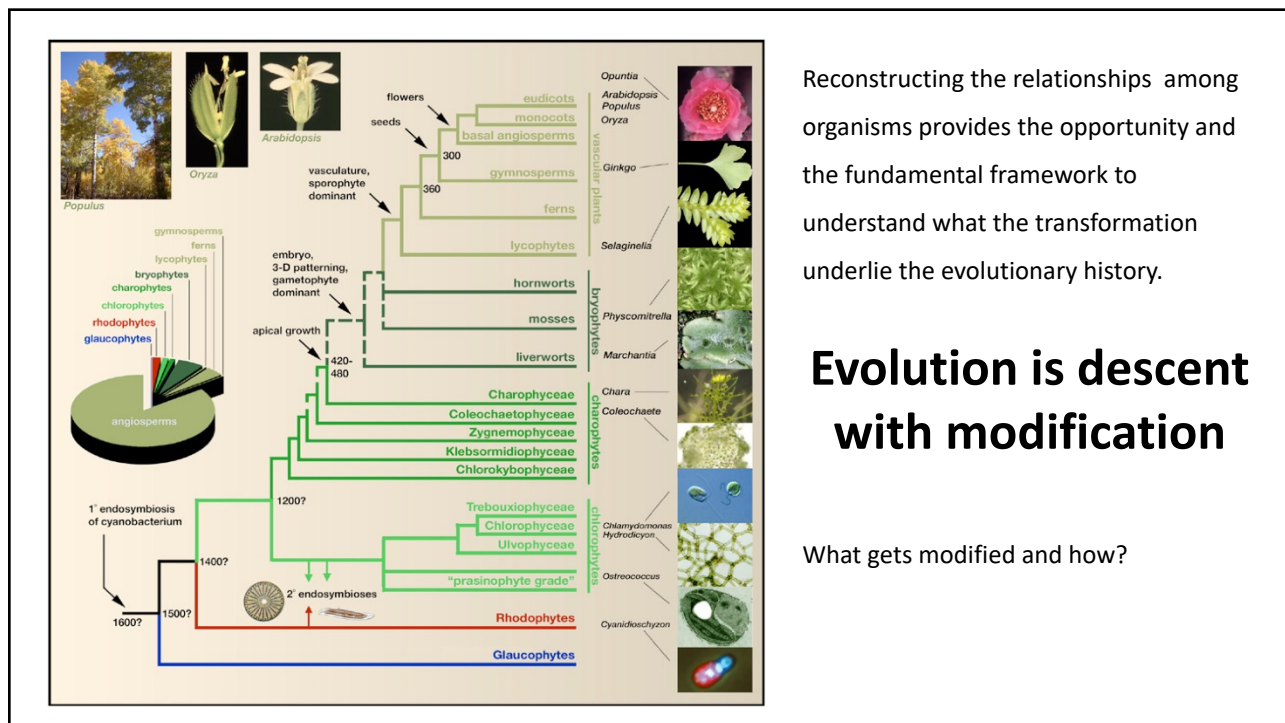


Next discussion

An Ancient Mechanism Controls the Development of Cells with a Rooting Function in Land Plants

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Today's land flora is dominated by flowering plants.

The ancestors to land plants were freshwater algae.

Bryophytes are a sister lineage to vascular plants, with whom they share a common ancestor from whom they inherited the same tool kit as vascular plants.

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Clade	Ancestral	Novel	Novel Core	Lost
Alveolates	8851	+885	50	-176
Archaeplastida	4987	+502	1	-1741
Chlorophyta	8554	+2167	-293	
Charophyta	7388	+202	209	
Embryophyta	9706	+1422	55	
Embryophyta	9481	+713	16	-294
Monocots	12751	+2525	-344	-1196
Eudicots	9380	+148	1	-1
Eudicots	10105	+366	1	-2

We can now sequence the entire genome (**genomics**) and compare the size and content of the genomic toolbox between lineages.

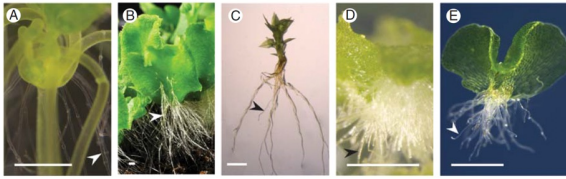
This is essential but it does not tell us what?

To test for the function of the gene, we can first assess when it is expressed (= **transcriptomics**), is the expression linked to a particular trait.

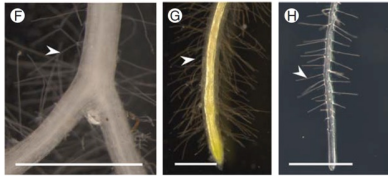
To test this hypothesis, we can genetically modify the organisms and alter or knock-out the gene, and assess its impact on the trait.

4

Focal trait of this amazing study: filamentous hairs associated to anchoring and absorption.



Jones & Dolan. 2012. Annals of Botany 110: 205–212.



Rhizoid and root hair morphology in *Chara braunii* and land plants: (A–E) **rhizoids** and (F–H) **root hairs**. (A) Rhizoids of *Chara braunii*; (B) rhizoids of the liverwort *Marchantia polymorpha* gametophyte; (C) **multicellular rhizoids on the moss *Physcomitrella patens* gametophyte**; (D) rhizoids of the hornwort *Anthoceros punctatus* gametophyte; (E) rhizoids on the gametophyte prothallus of the fern *Ceratopteris richardii*; (F) root hairs on the root of the *Selaginella kraussiana* sporophyte; (G) root hairs on the root of the fern *Ceratopteris richardii* sporophyte; (H) **root hairs of the angiosperm *Arabidopsis thaliana* sporophyte**. Arrowheads indicate rhizoids or root hairs. Scale bars . 1 mm.

Vascular plants and bryophytes differ in many ways, and first and foremost by their life cycle: the vegetative body of bryophytes is the gametophyte, whereas that of the vascular plants is the sporophyte.

Note that ferns have also a free-living gametophyte.

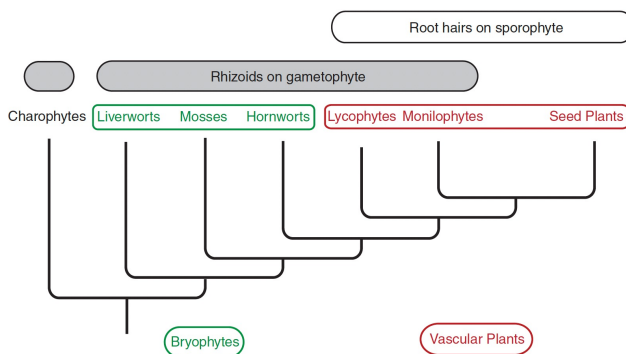
Although they differ in many ways, bryophytes and vascular plants also share numerous traits, because they

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Are the “shared” and “similar” traits based on the same tools performing the same function?

5

Focal trait of this amazing study: filamentous hairs associated to anchoring and absorption.



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The occurrence of rhizoids and root hairs in extant land plant lineages. Streptophyte algae are the closest relatives of land plants, and some members possess rhizoids. Rhizoids develop on the gametophytes of some land plants (liverworts, mosses, hornworts, lycophytes and monilophytes). Root hairs are found only on the roots of the sporophytes of vascular plants. The lycophytes and monilophytes develop both rhizoids on their gametophytes and root hairs on their sporophytes. Rhizoids are multicellular in the mosses. All other land plants develop unicellular rhizoids and root hairs. Tree after Qiu et al. (2006).

All land plants develop filamentous hairs, aimed at absorbing water and mineral nutrients.

To confirm their homology we would need to:

1. _____ (=> shared ancestry)
2. _____ (=> function)
3. _____ (=> persisting homology)

Note this study is from 2012, when bryophytes were ‘still’ thought to compose a paraphyletic group (meaning?) to vascular plants.

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