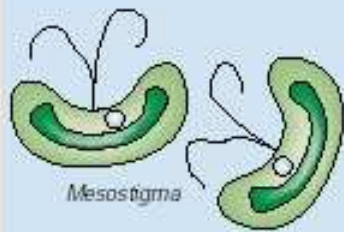


Evoluční pohled na vývojovou biologii rostlin

Box 3 | Outline summary of some important innovations of plant evolution

Aquatic Algal level



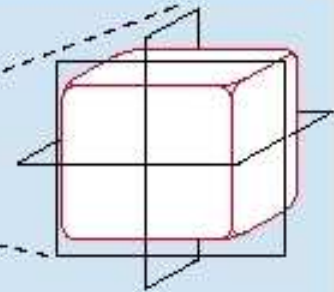
Mesostigma



Klebsormidium



Coleochaete



Unicellular to filamentous transition. Products of mitosis do not separate, thus forming long filaments. Plane of division is always parallel to the direction of growth. Filaments can produce mats, which, by trapping evolved oxygen, can rise to the water surface (the photic zone). Evolved: several times. *Klebsormidium* image © Yuuji Tsukii, Japan.

Filamentous to parenchymatous cell division. A complex multicellular organism can form only if cell division occurs in more than one plane. This requires sophisticated control of a developmental mechanism that regulates cell division in response to external signals. Evolved: several times. Example: *Coleochaete* image © Mike Clayton, USA.

Terrestrial

Colonization of the land



Rhytnia fossil

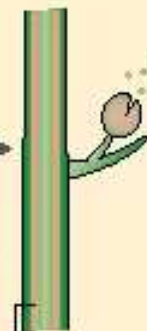
Cuticle Stoma



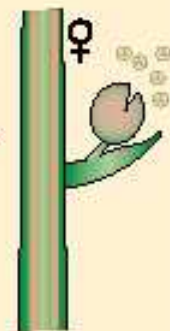
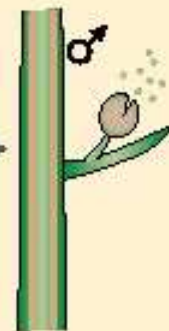
Cooksonia fossil

Sporangia

Alternation of generations
 $2n \leftrightarrow n$



Sporopollenin coated spore



Secretion of a hydrophobic chemical layer onto the surface of the plant (cuticle). Evolved: once. With the evolution of the cuticle, an alternative system for gas exchange is needed, rather than diffusion across the plant surface. Cuticularized parts of bryophytes have stomata (breathing pores), as do the pteridophytes and seed plants. Evolved: probably once.

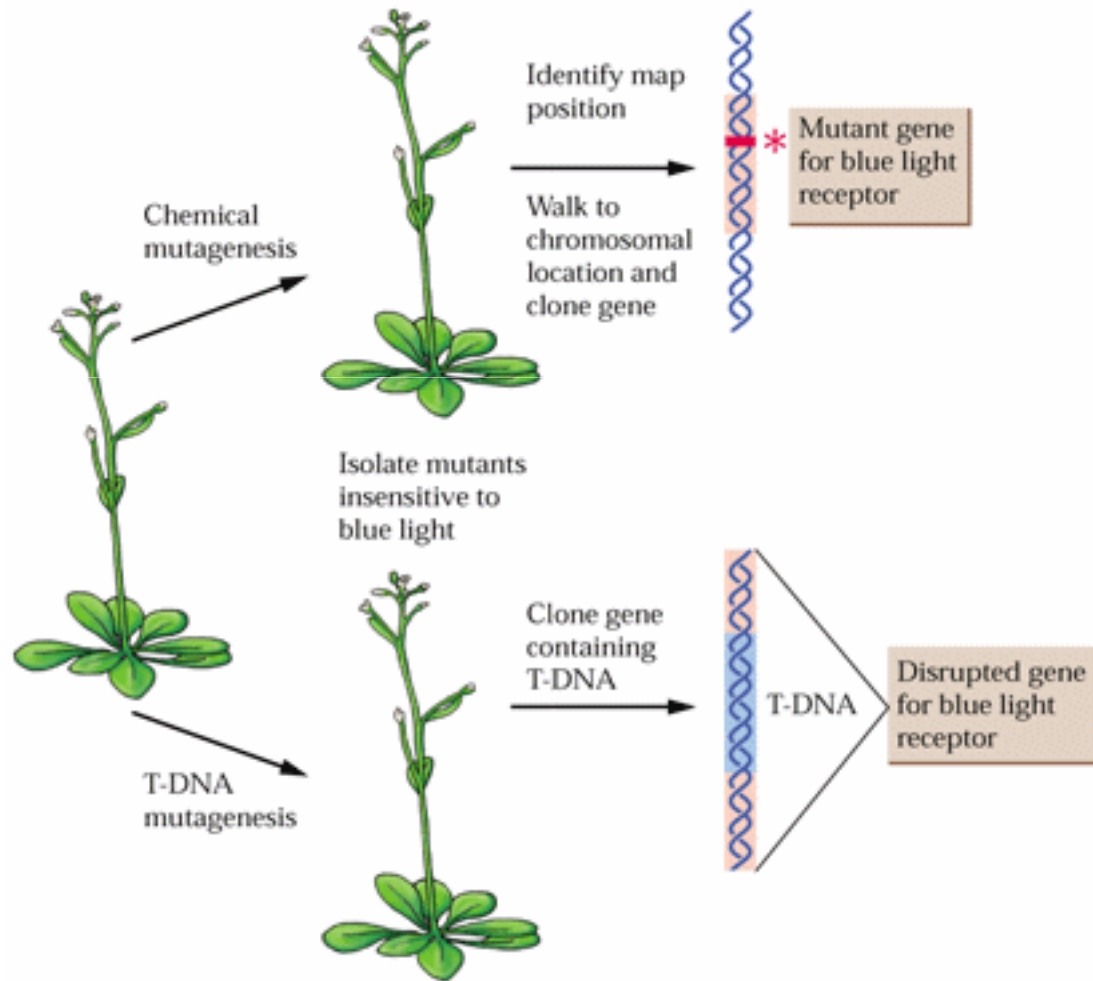
All land plants have sporopollenated spores, which is thought to protect the spore from the hostile aerial environment. The microspore cannot avoid traveling through this hostile aerial environment, as it is a principal instrument of gene flow in the population of otherwise stationary organisms. Evolved: once. *Cooksonia* and *Rhytnia* images © Hans Steur, The Netherlands.

Conducting tissue. All land plants have some sort of water-conducting tissue. In mosses, this is called a hydrome. In vascular plants, this is better developed and is called xylem. Evolved: probably once.

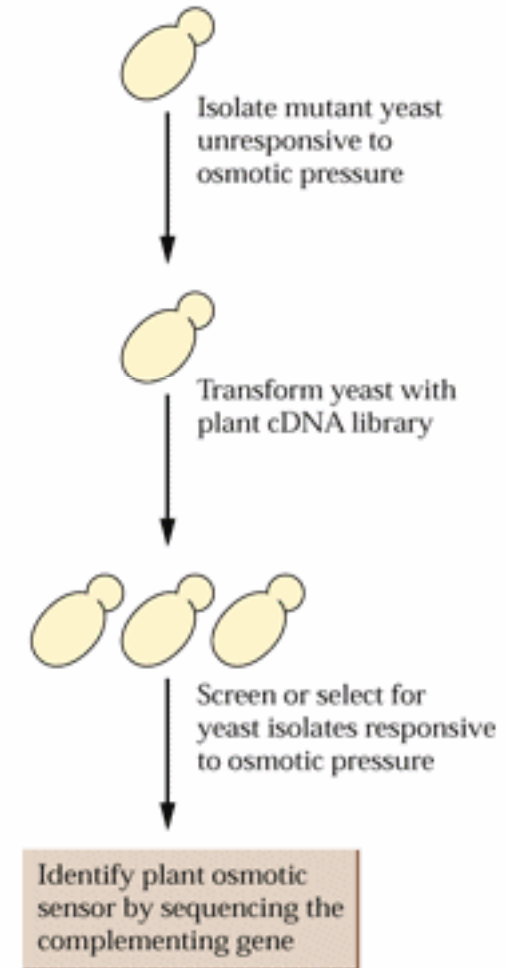
Homosporous to HETEROSPOROUS transition. The evolution of a large female megaspore with more resources than the small microspore represents an important evolutionary division of function, requiring a new developmental control of sex expression. Evolved: several times (at least six, probably nine), but once in the seed-plant lineage.

Metody studia rostlinných genů řídících ontogenezi.

(A) Chemical mutagenesis vs. T-DNA mutagenesis



(B) Complementation of mutant yeast



METODY STUDIA AKTIVITY PROMOTORŮ

Use of a reporter gene – gene whose expression is easy to observe. Used to “report” gene expression - regulation and localization

- Green fluorescent protein (GFP)

Protein identified from luminescent jellyfish *Aequorea victoria*. GFP has now been produced in a number of heterologous cell types and there appears to be little requirement for specific additional factors for post-translational modification of the protein, which may be autocatalytic or require ubiquitous factors. Many structural variants now available commercially (e.g. red fluorescent protein)



A. thaliana C24 wild type (left)
35S-mgfp4-ER transformed (right)

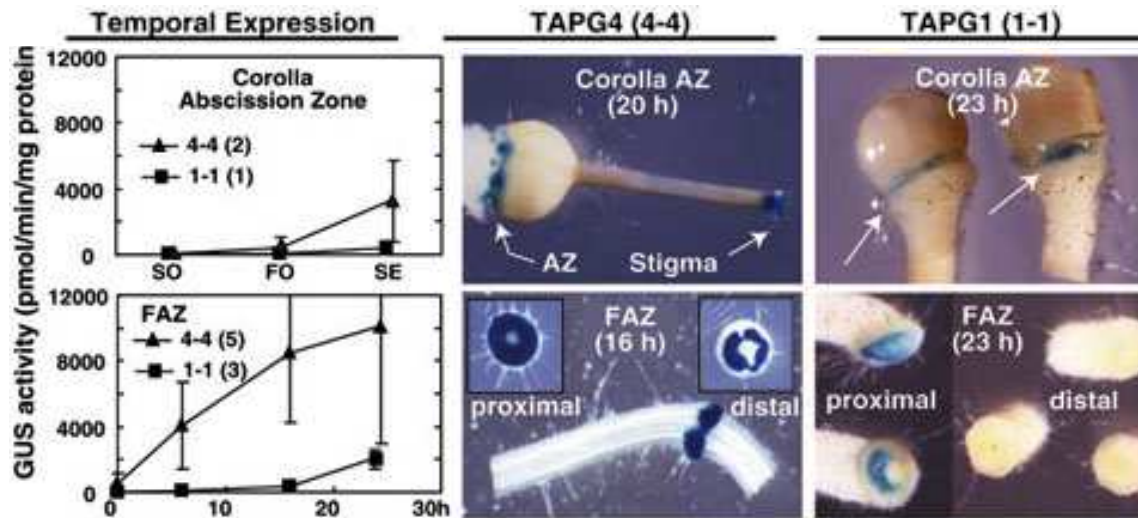
Aequorea victoria

<http://www.plantsci.cam.ac.uk/Haseloff/GFP/GFPbackgrnd.html>
http://pantheon.cis.yale.edu/~wfm5/gfp_gateway.html

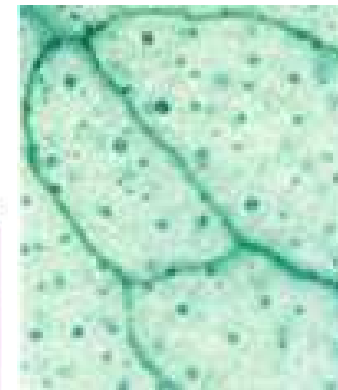
- GUS (*uidA*) gene



5-bromo-4-chloro-3-indolyl
- β -D-glucuronic acid



ABA-inducible expression



Guard cells

Roots

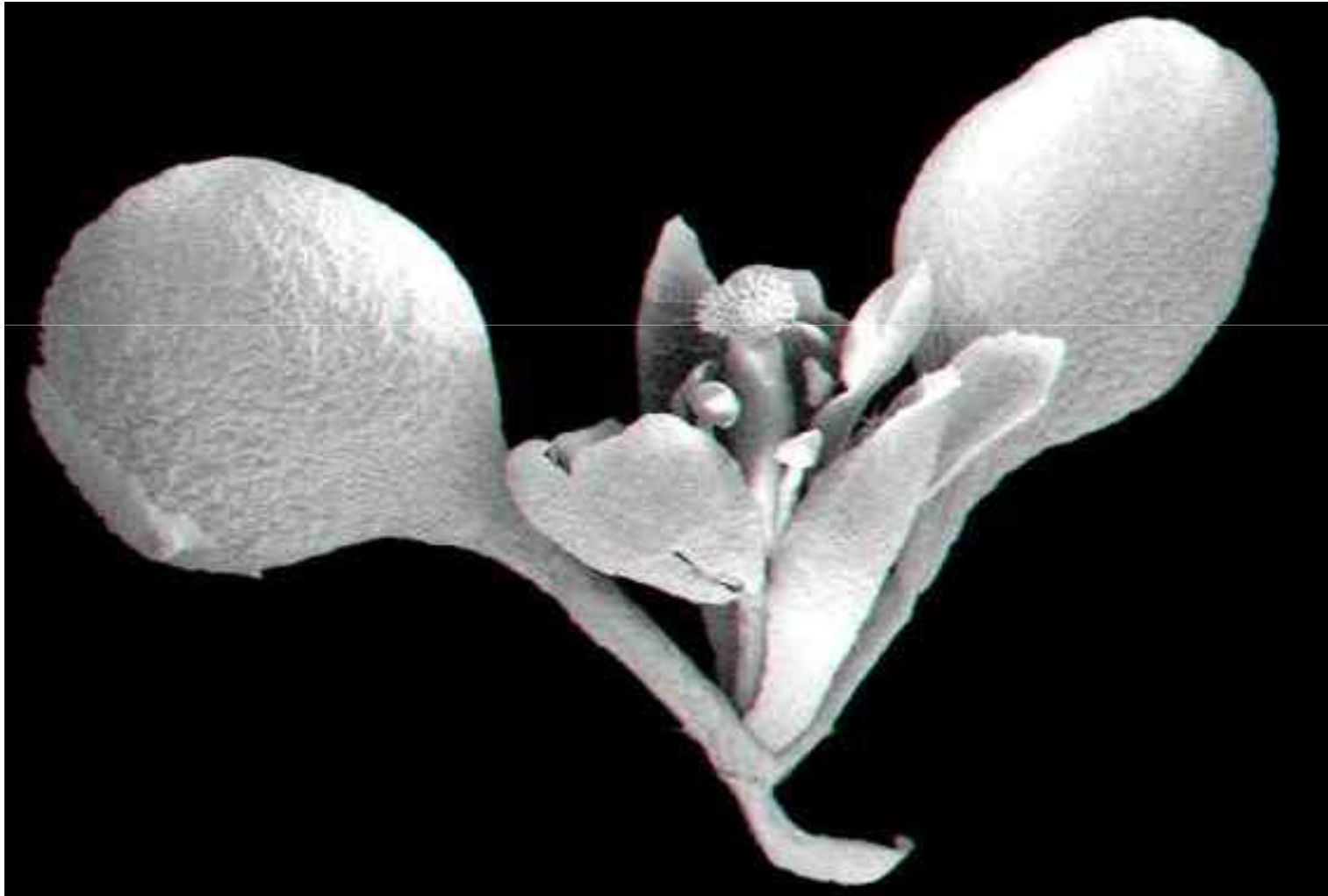
<http://home.ust.hk/~rocklab/dc3gus/>

http://bldg6.arsusda.gov/mtucker/Public/images/F2_TAPG_GUS.html

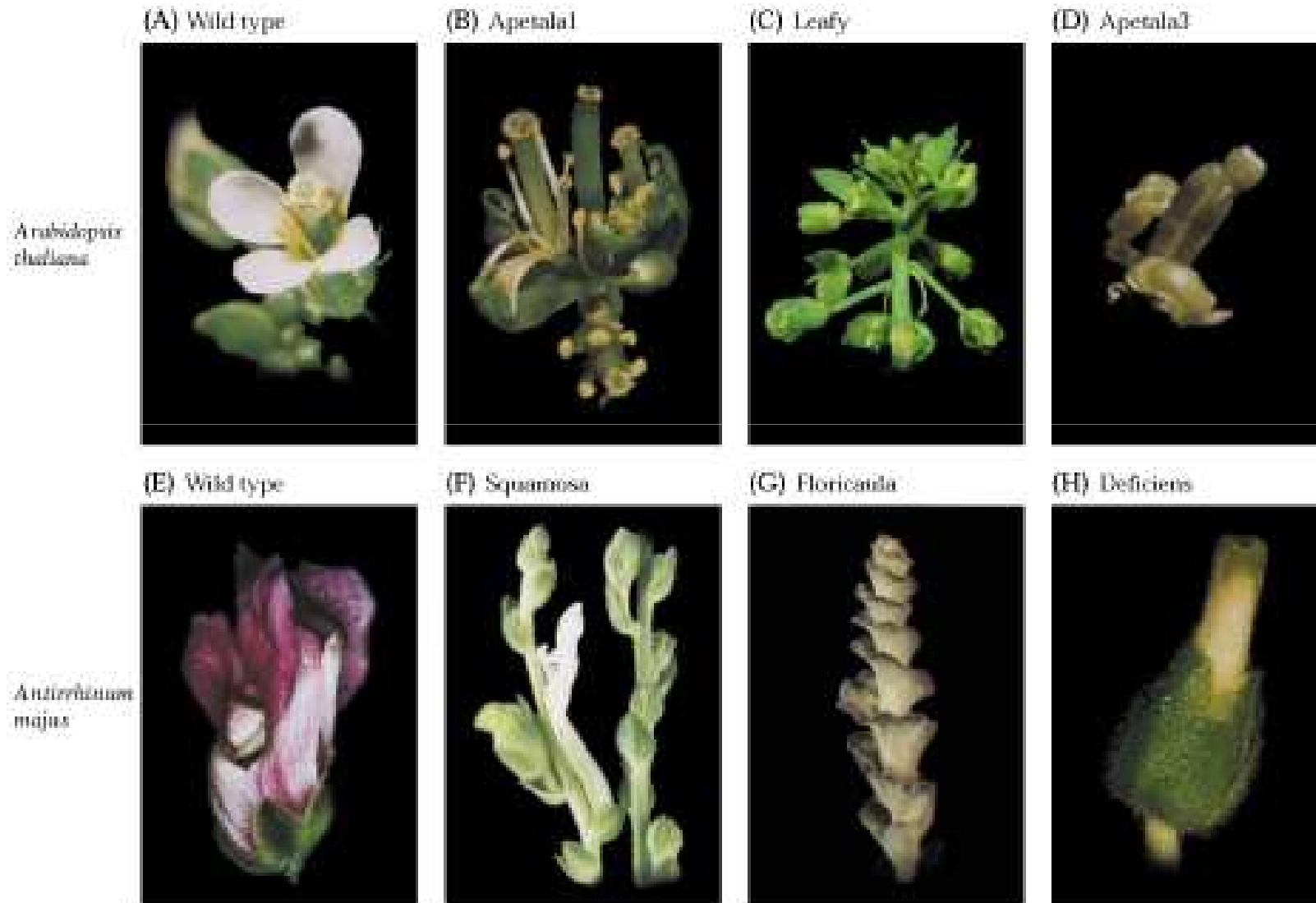
Embryonic flower mutant

Po „knock-outu“ represoru
kvetení, kvete již klíčnící
rostlinka Arabidosis

REPRESORY



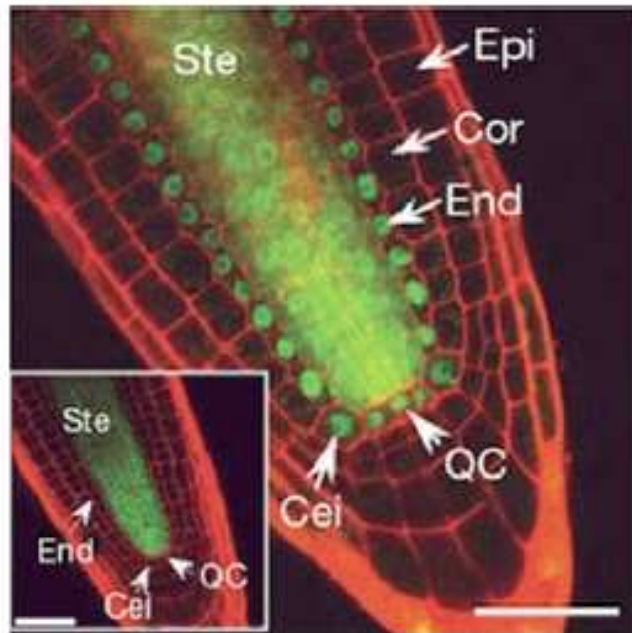
Homeotiční květní mutanti



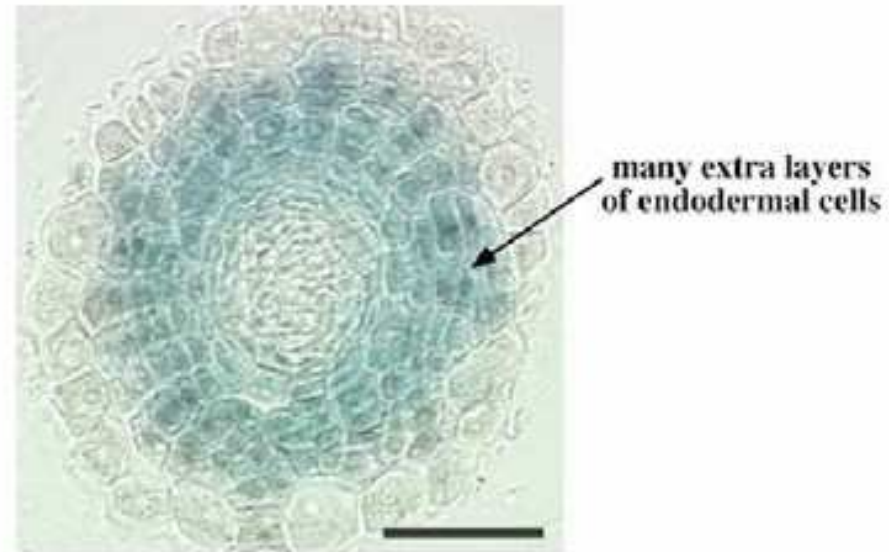
analogie s homeotickými mutanty r. *Drosophila*...

SHR protein je transportován ze stele do
sousední buněčné vrstvy – endodermis,
iniciál a klidového centra

SHR bílkovina



SCR::SHR



Left: SHORTROOT promoter driving expression of a SHORTROOT-GFP fusion protein. Inset: expression pattern of SHORTROOT promoter. The SHORTROOT-GFP protein is capable of movement to adjacent cells in the endodermis, initials and quiescent centre. Right: Ectopic expression of the SHORTROOT protein causes proliferation of the endodermis, marked by a β -glucuronidase reporter gene.