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Growth induced water potential gradient

When plants are deprived of water, they become flabby. Plants control their shape by maintaining intracellular pressure thanks to the vacuole, an organelle that concentrates osmolytes, which trigger water influx. The counteraction of the cell wall elasticity generates the turgor pressure. Plant growth requires water fluxes that are generated by gradients of water potential between the growing cells and the water source.

The maintenance of water-potential gradients lies at the central basis of plant morphogenesis. Without osmolyte synthesis, growth would make the internal pressure decrease. Considering two identical neighboring cells with a similar osmolyte production rate, the one growing the quickest would have the lower water potential. Based on this consideration, Molz and Boyer in the early seventies developed a theory of water potential gradient self-maintained by growth itself. Despite decades of active investigation the question remains a matter of debate.

The training aims to measure water potential gradient and growth simultaneously in the simplest multicellular model, corticated *characeae* constituted by a central internodal cell covered by a layer of cortications. It will involve the use of a pressure probe both to the measure the pressure and to sample the cellular content in order to retrieve the osmotic potential. Growth patterns will be monitored using extremely precise techniques of tracking developped in the lab. In parallel, a theoretical analysis will be done to test if the measured water-potential gradients are solely sustained by the observed growth.

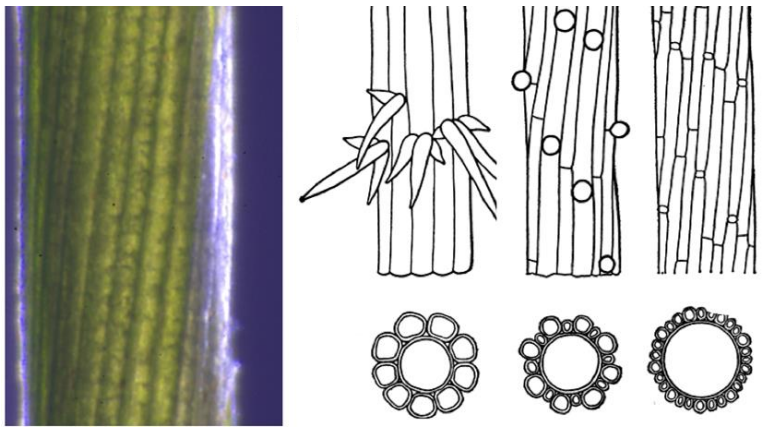

Figure. (Left) Corticated internode of *C. clobularis*. (Right). *Characeae* with cortications[24]: *C. canenscens, C. contraria, C. fragilis.* Up. Lateral view: The corticationsinclination is varying from species to species.Down. Transversal view: A big central internode surrounded by smaller cortications.