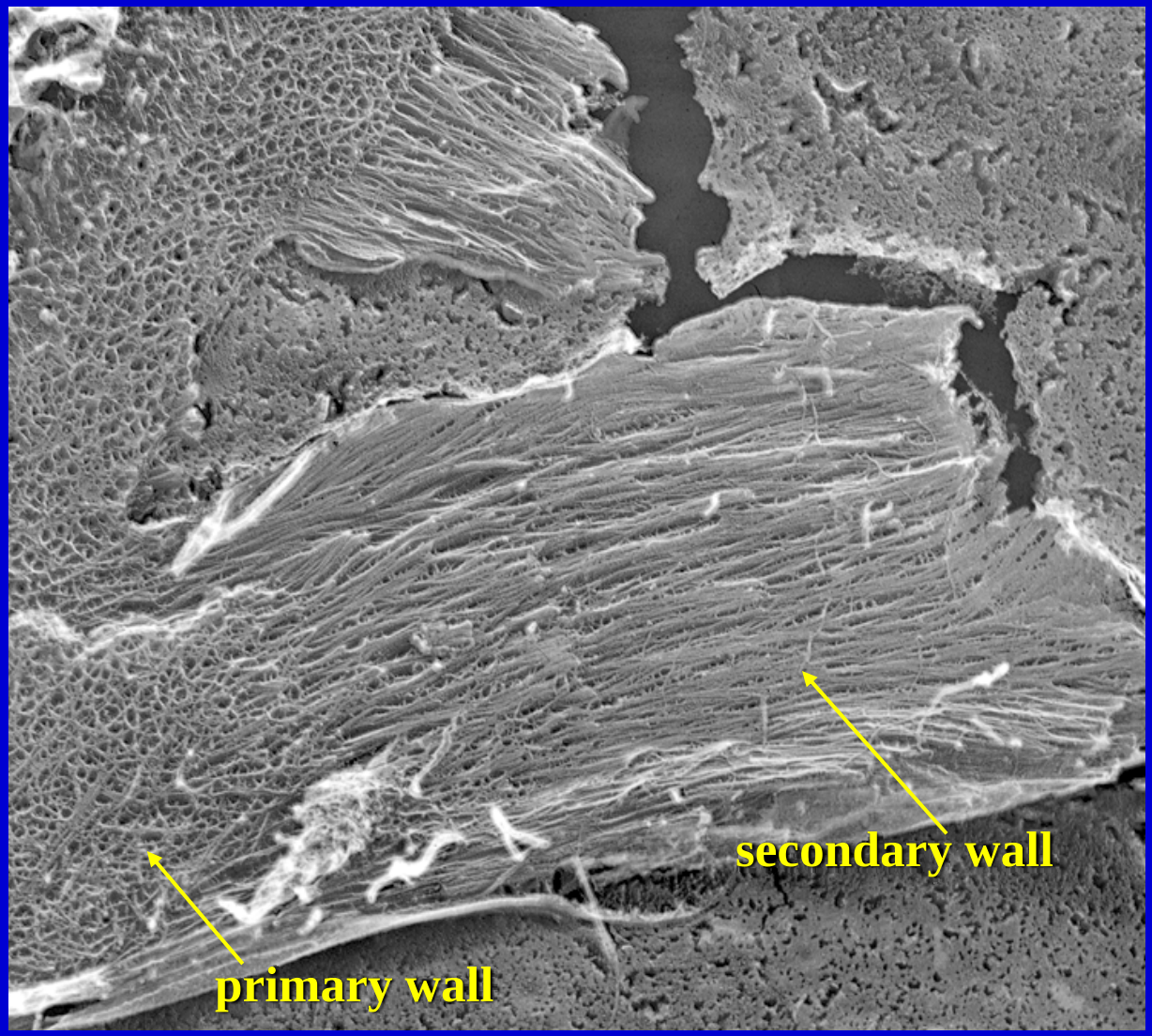


Cellulose biogenesis builds a structural nanofibril within an ordered cell wall.

Because cell walls are the plant “skeleton”, cellulose is the most abundant macromolecule synthesized by plants.

10^{11} tons are synthesized and destroyed each year.

Cellulose-based products

timber fiber forage chemical cellulose

pulp fuel for burning biofuels

lumber and manufactured wood products

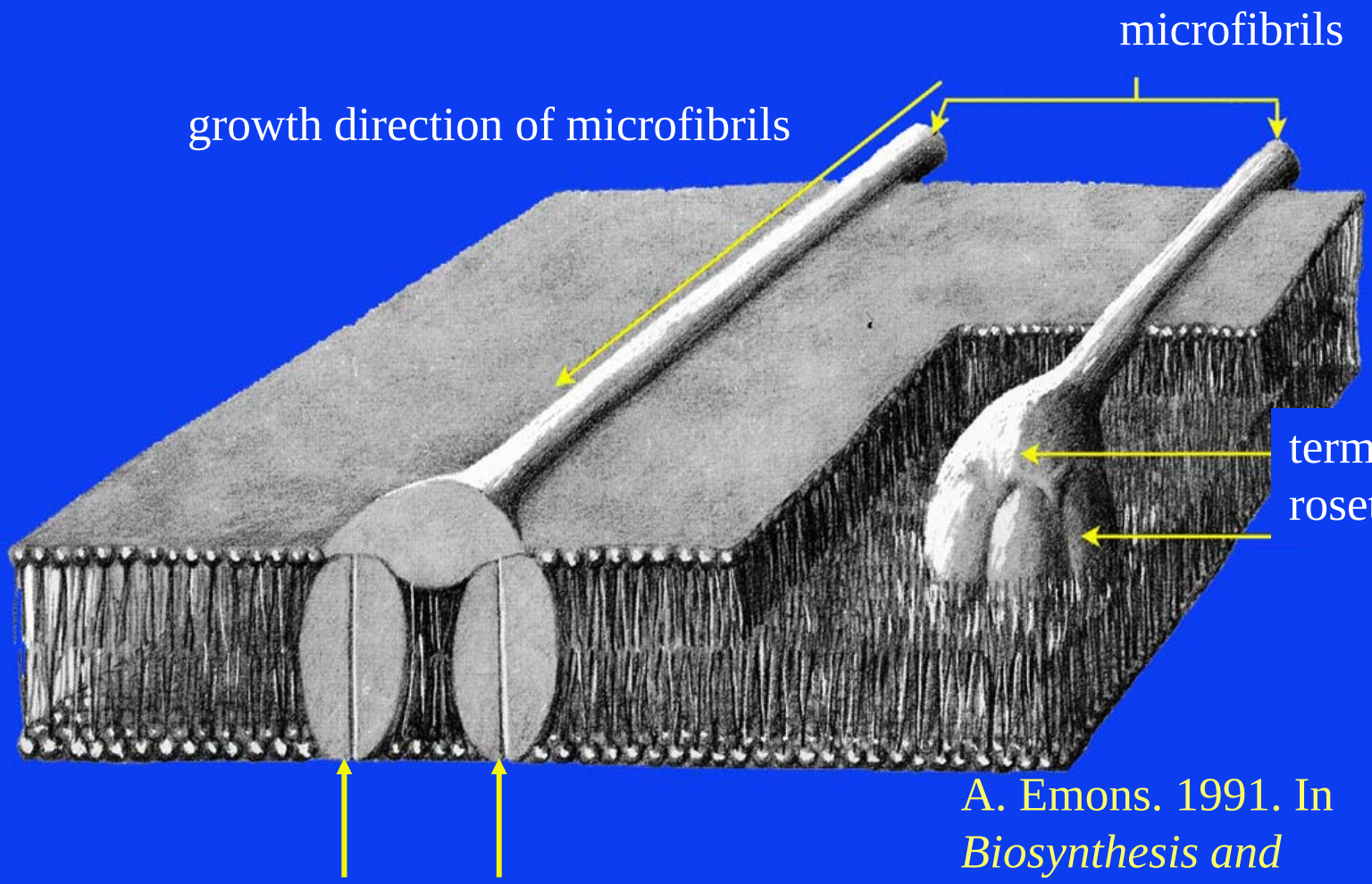
animal feed paper textiles

sacking and boxing material cordage

brushes and brooms filling and stuffing

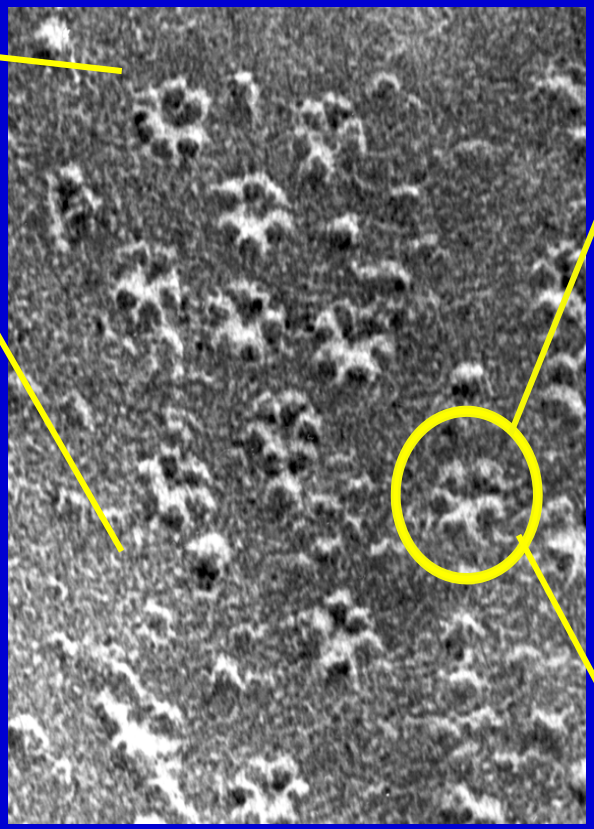
caulking filters thickeners

Cellulose synthesis is highly organized within the cell.
Rosettes move within the plasma membrane as they spin out cellulose microfibrils.

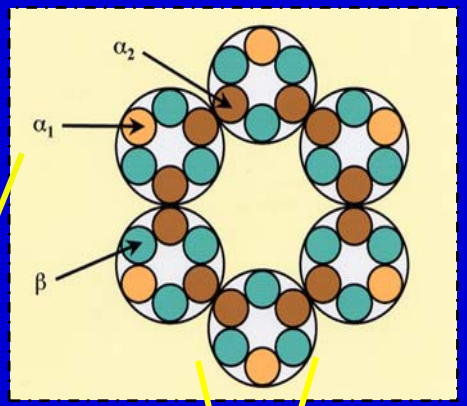


A. Emons. 1991. In *Biosynthesis and Biodegradation of Cellulose.*

Rosette terminal complexes on the PF-face of the plasma membrane of a *Zinnia elegans* tracheary element



Doblin et al. 2002



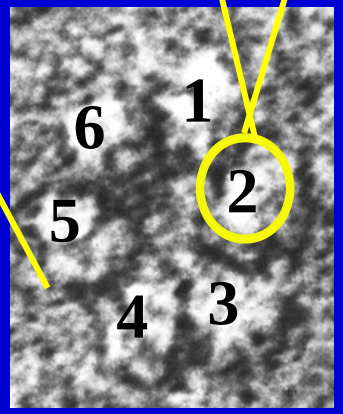
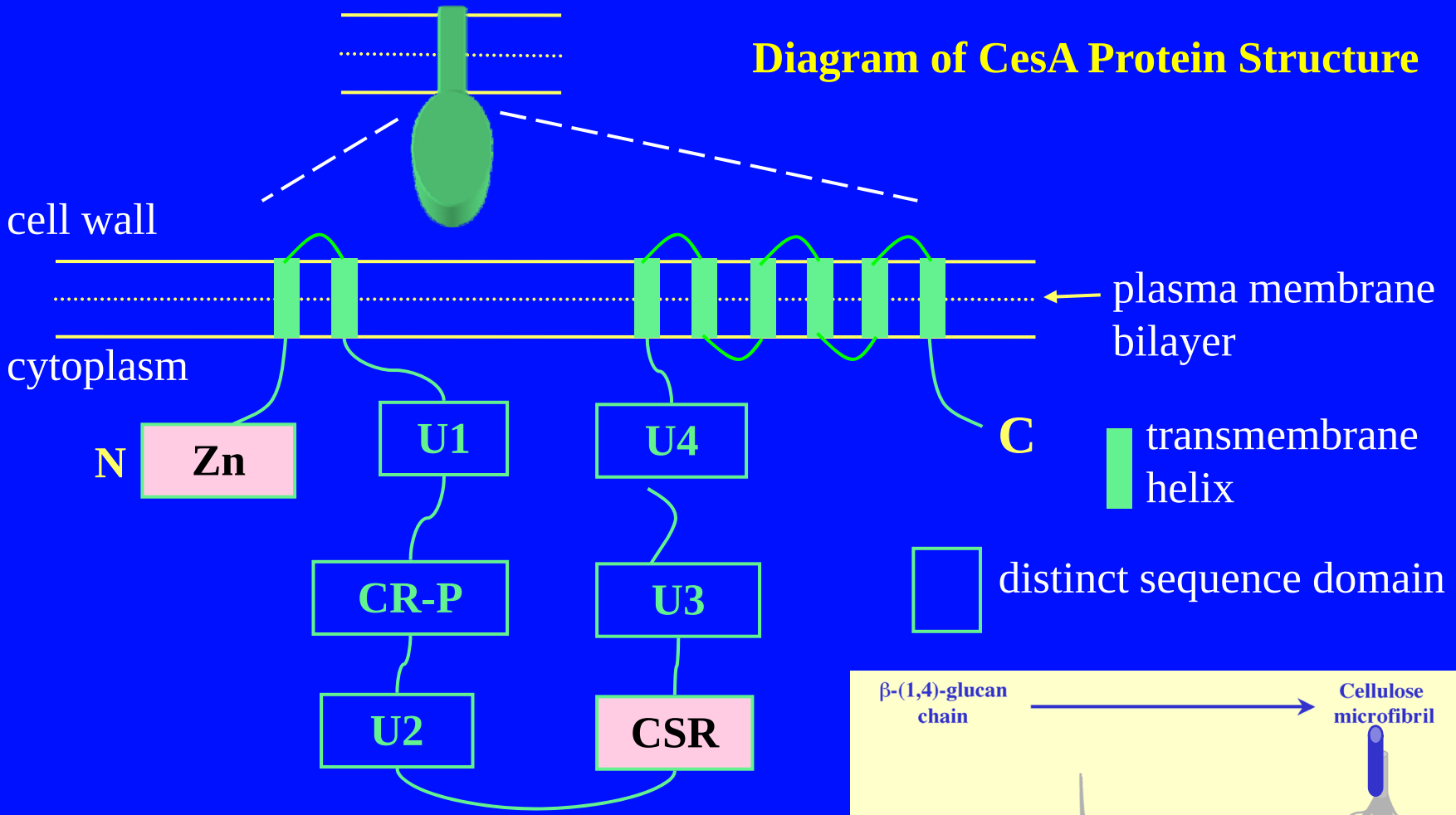
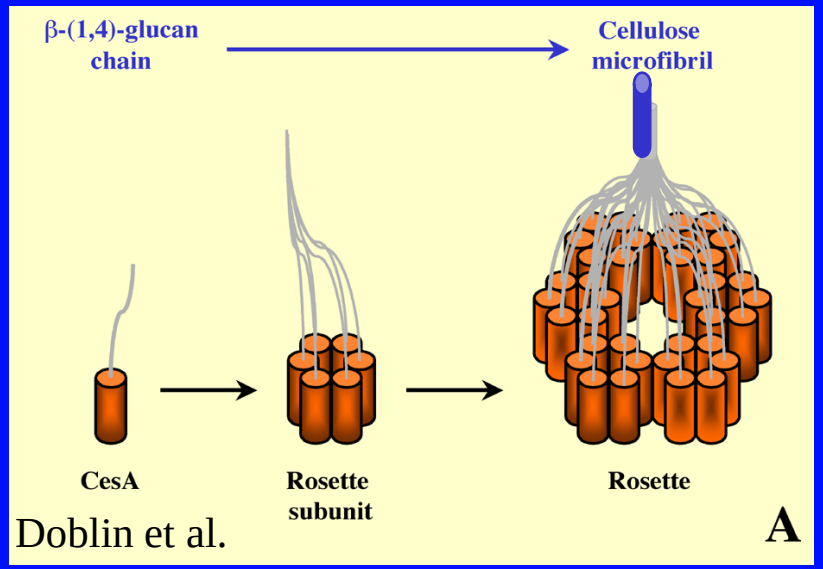


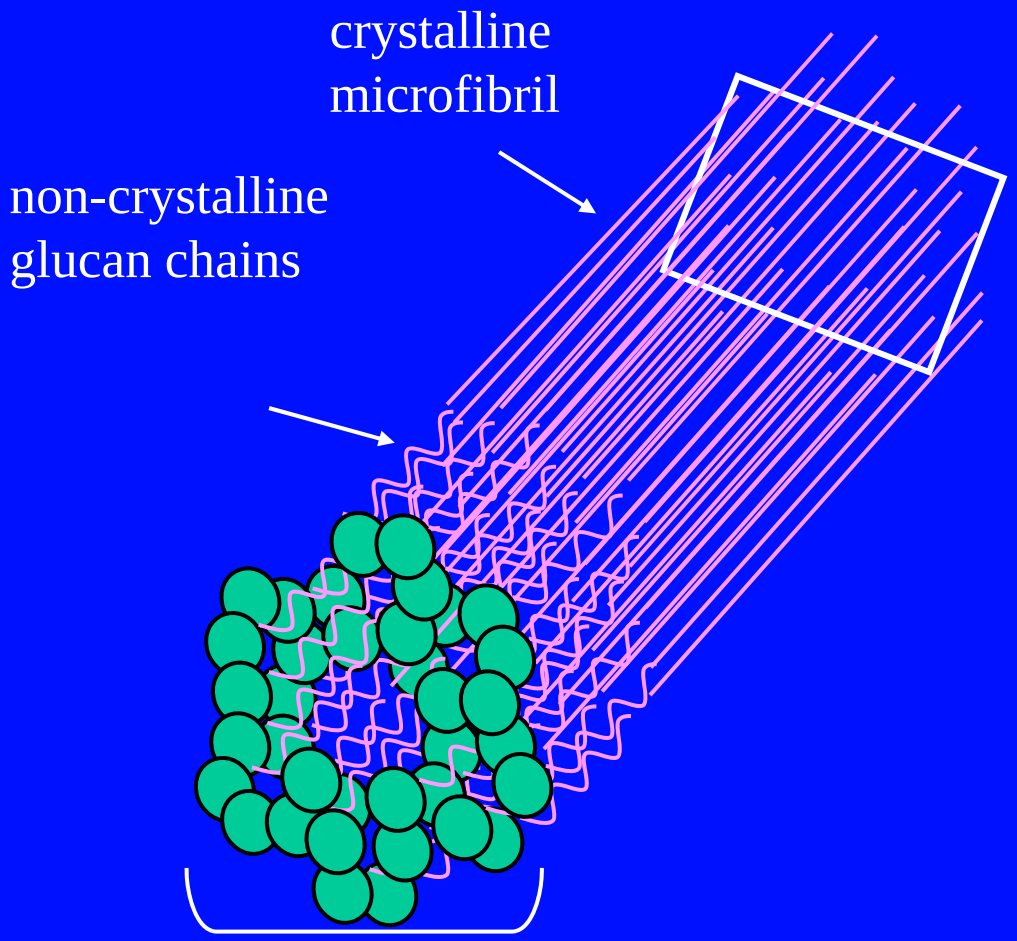
Diagram of CesA Protein Structure



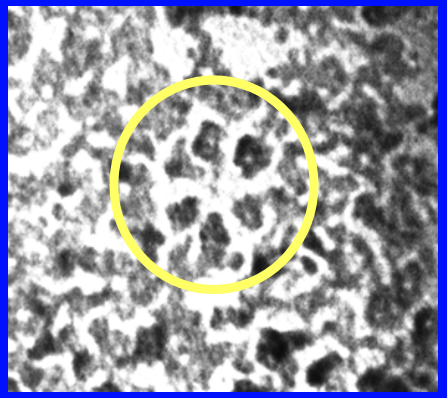
U1, U2, U3: conserved aspartate (D)
U4: conserved QxxRW motif
Zn, Zinc binding domain
CR-P, conserved region-plant
CSR, class-specific region



Immediately after polymerization, the ß-1,4 glucan chains are non-crystalline. Cellulose microfibril crystallization occurs between adjacent glucan chains synthesized by one rosette.



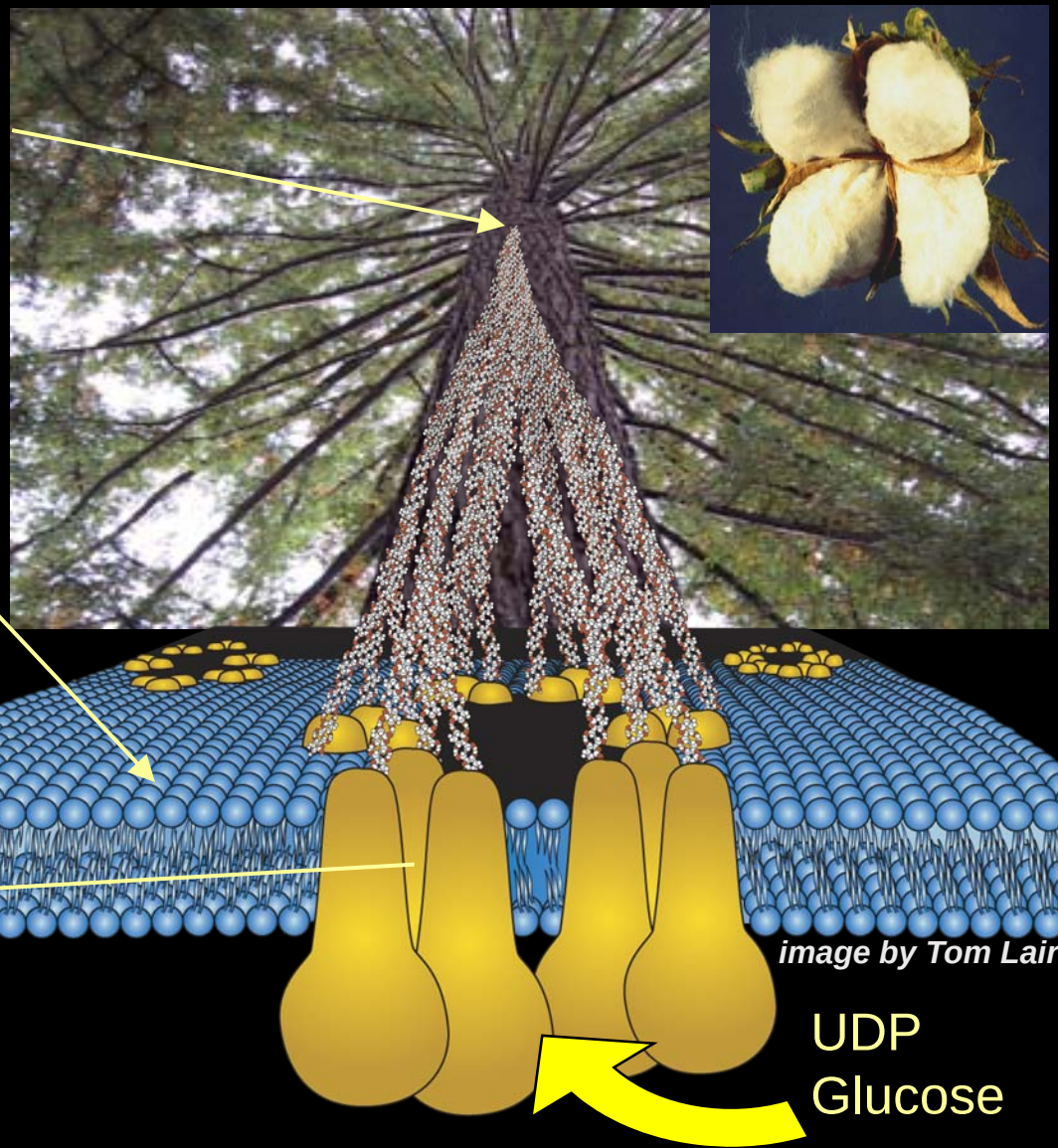
25 nm rosette--
normal microfibril formation

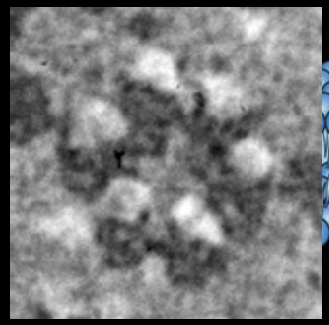


A freeze-fracture electron micrograph of a rosette embedded in the plasma membrane. This protein aggregation is an example of biophysical control.

Cellulose Synthase Proteins: Nature's Nanofibril Assembly Machines

Cellulose producing proteins ( ) forming a 'rosette'





TEM image of a rosette

25nm

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