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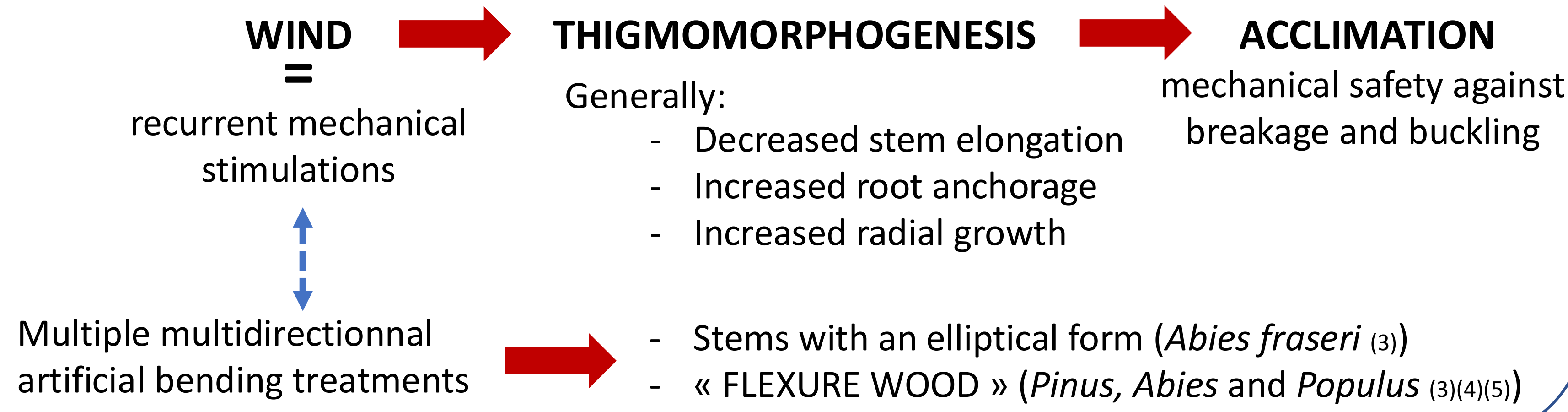


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The multiple mechanosensitive responses of wood formation to bending: a matter of sign of the strains, dose, and sensitivity adjustments

INTRODUCTION

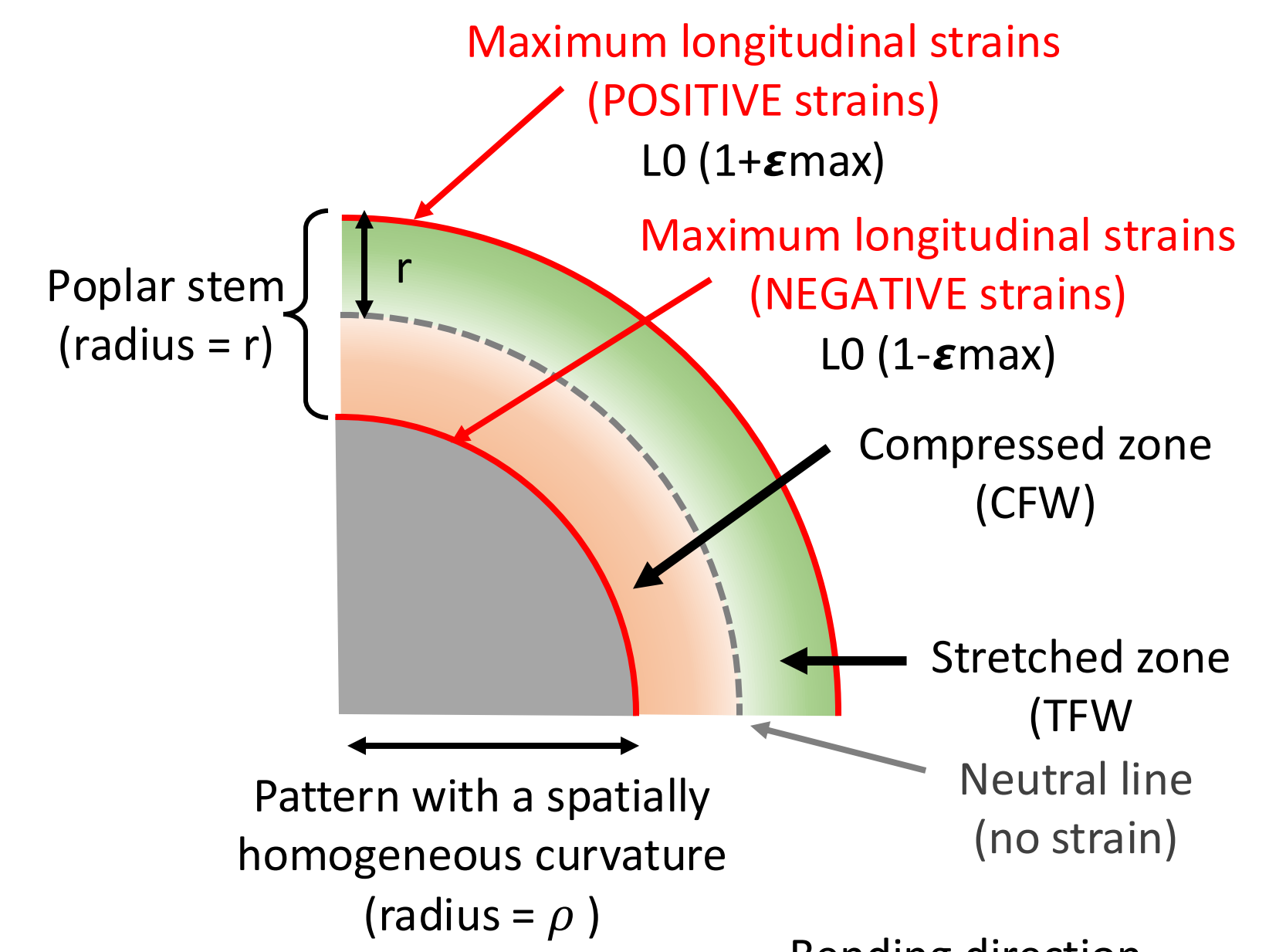
Tissue strains are sensed by plants (1) (2)



HYPOTHESIS

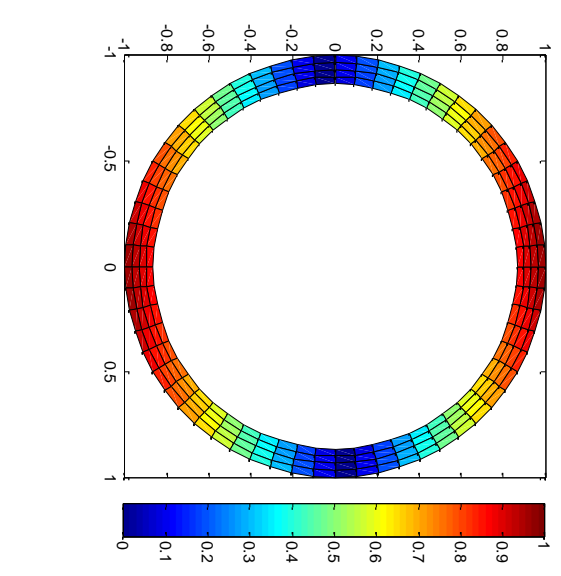
- Different types of specific local strains (strain amplitude and strain sign) could generate different radial growth and wood differentiation responses.
- There could be a dose-effect of bending on wood formation : a higher number of bending may modify the wood formation responses.

EXPERIMENTS

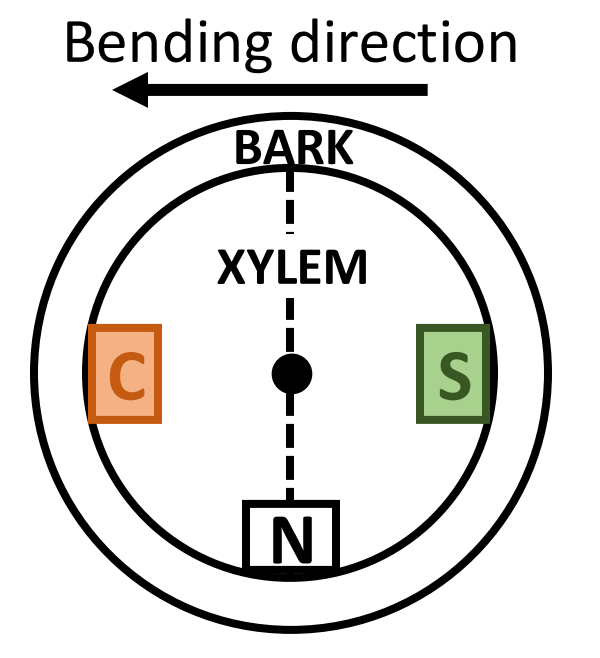


ε = strains
CFW = Compressive Flexure Wood
TFW = Tensile Flexure Wood

N = neutral zone
C = Compressed zone
S = Stretched zone



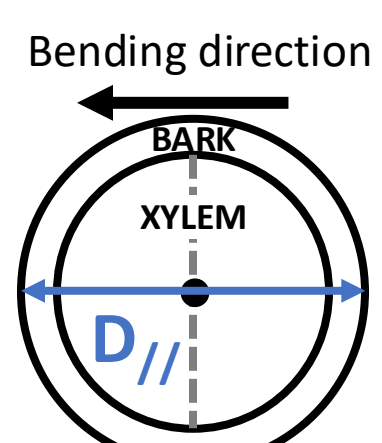
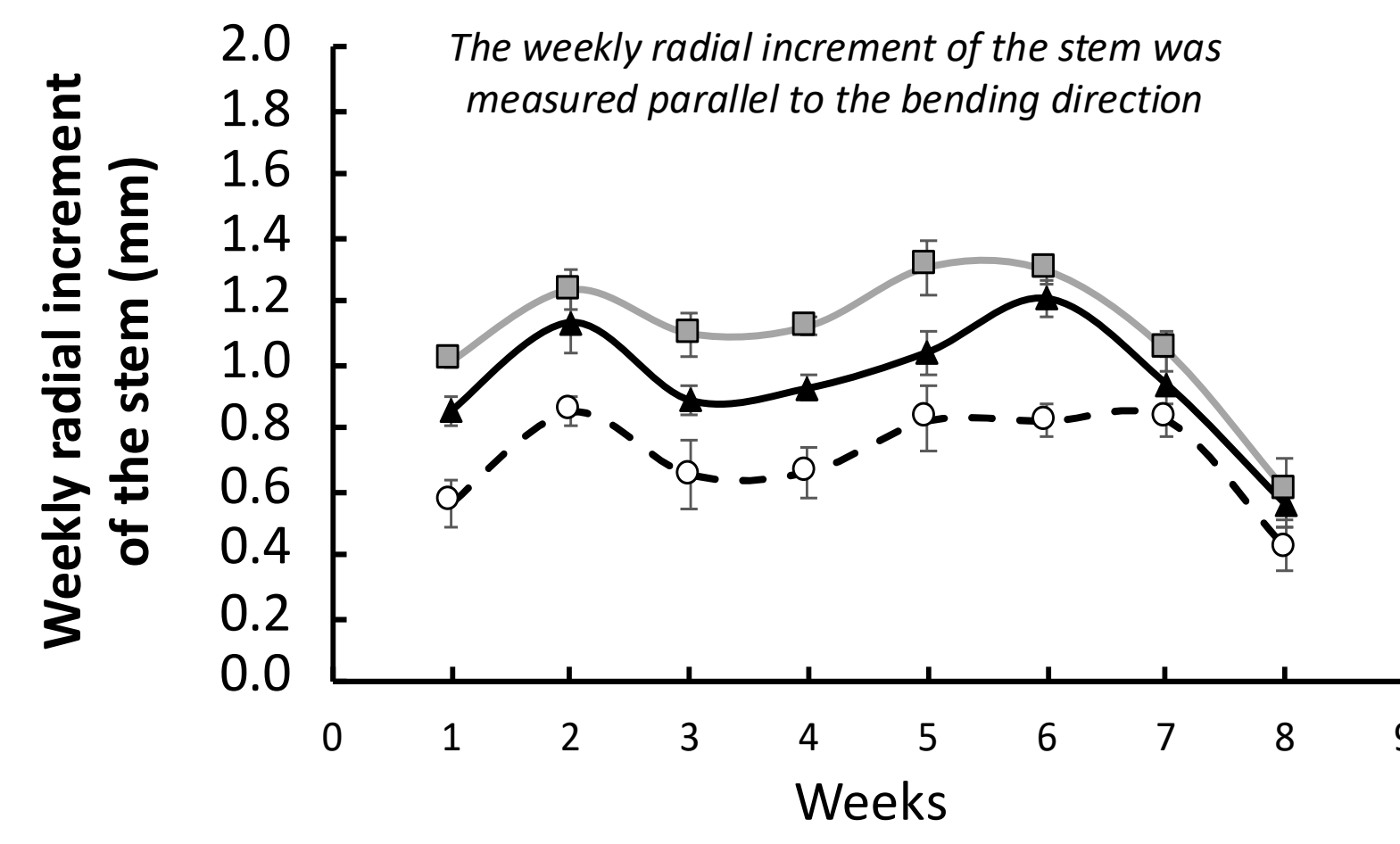
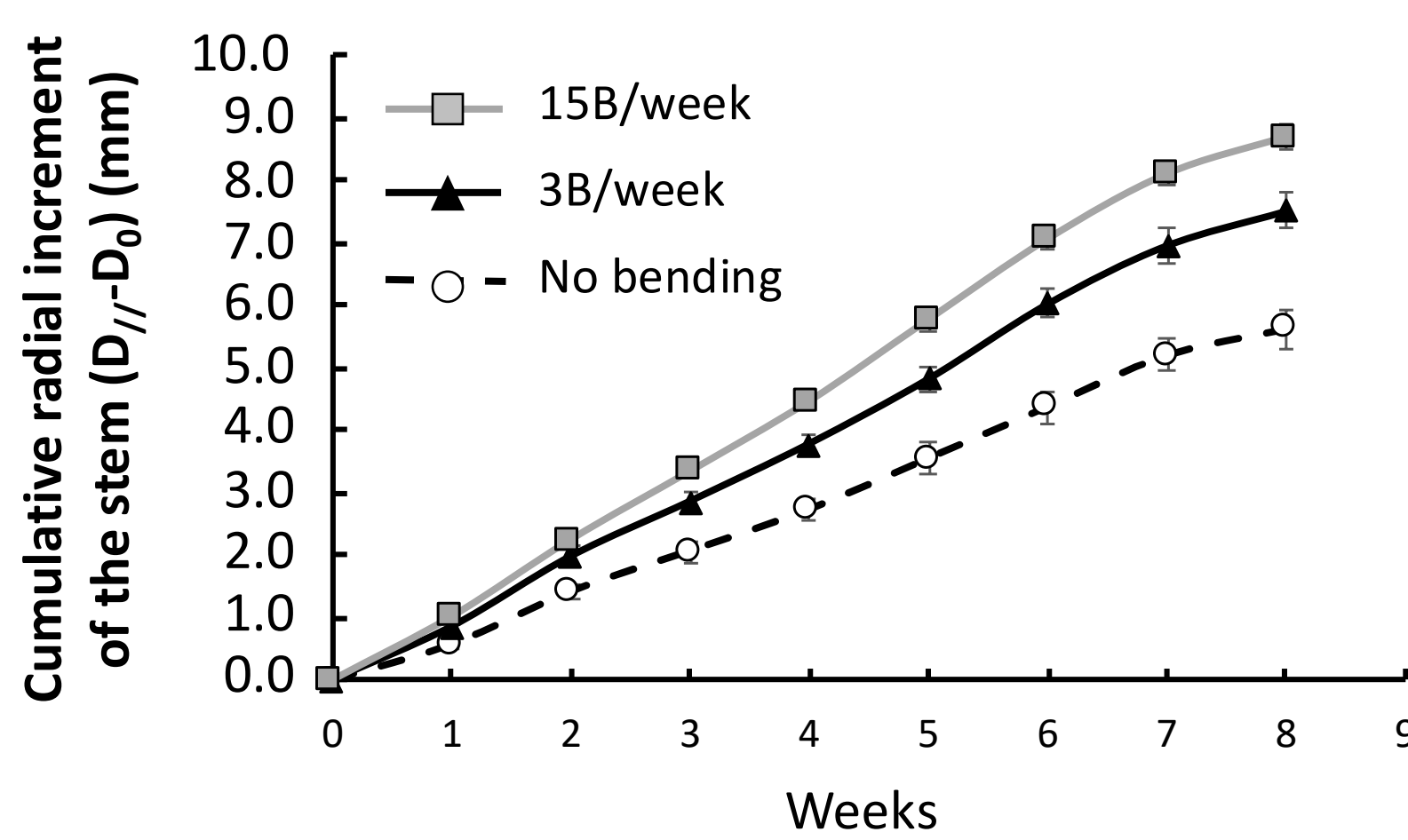
STRAIN FIELD (transverse plane)



Sampling scheme (transverse plane)

The effects of repeated bending on secondary growth

The number of bending treatments modulates the secondary growth



$D_{//}$ = diameter parallel to the bending direction

$D_0 = D_{//}$ the day of the first bending

3B/w < 15B/w

⇒ DOSE-EFFECT

3B/w ≠ 5 x 15B/w

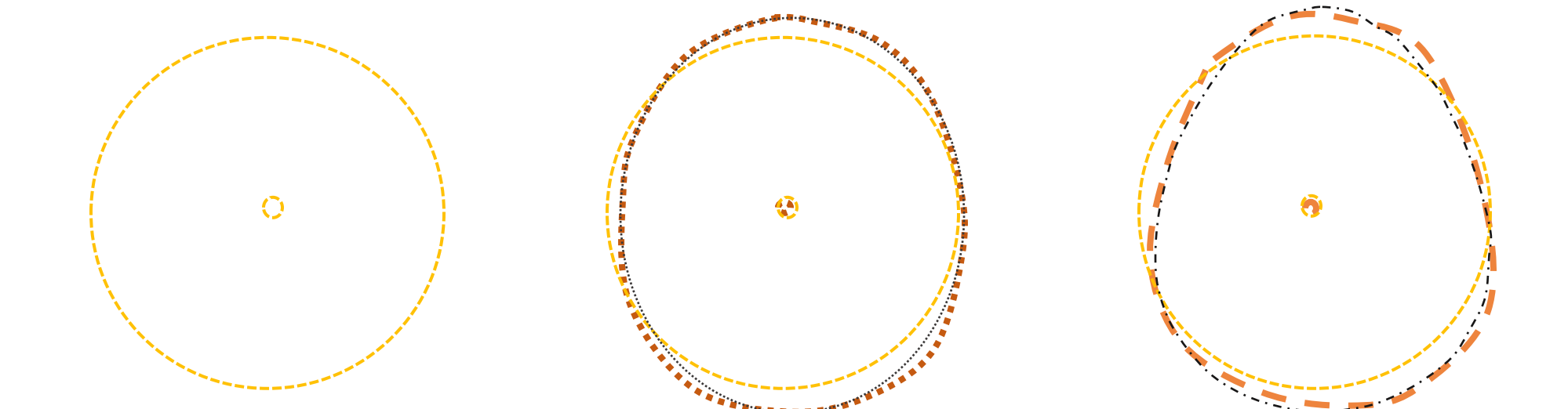
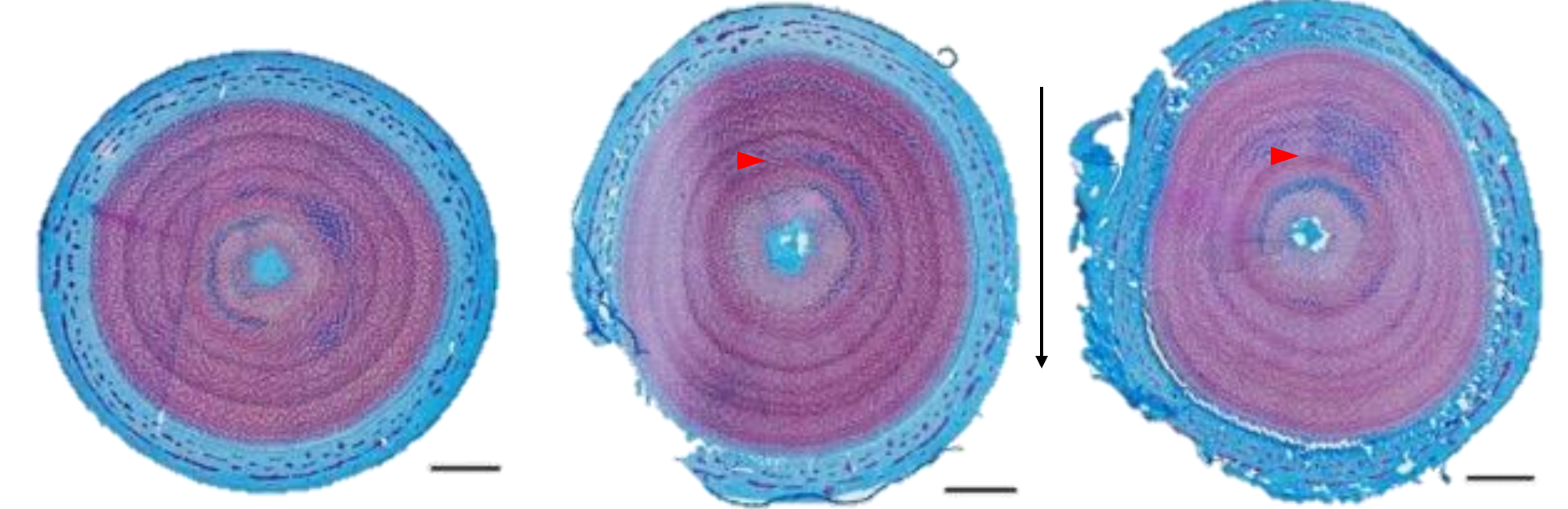
⇒ ACCOMMODATION

The response isn't linear

to successive stimulations

Increasing the dose reveals new abilities of wood cells to respond to bending

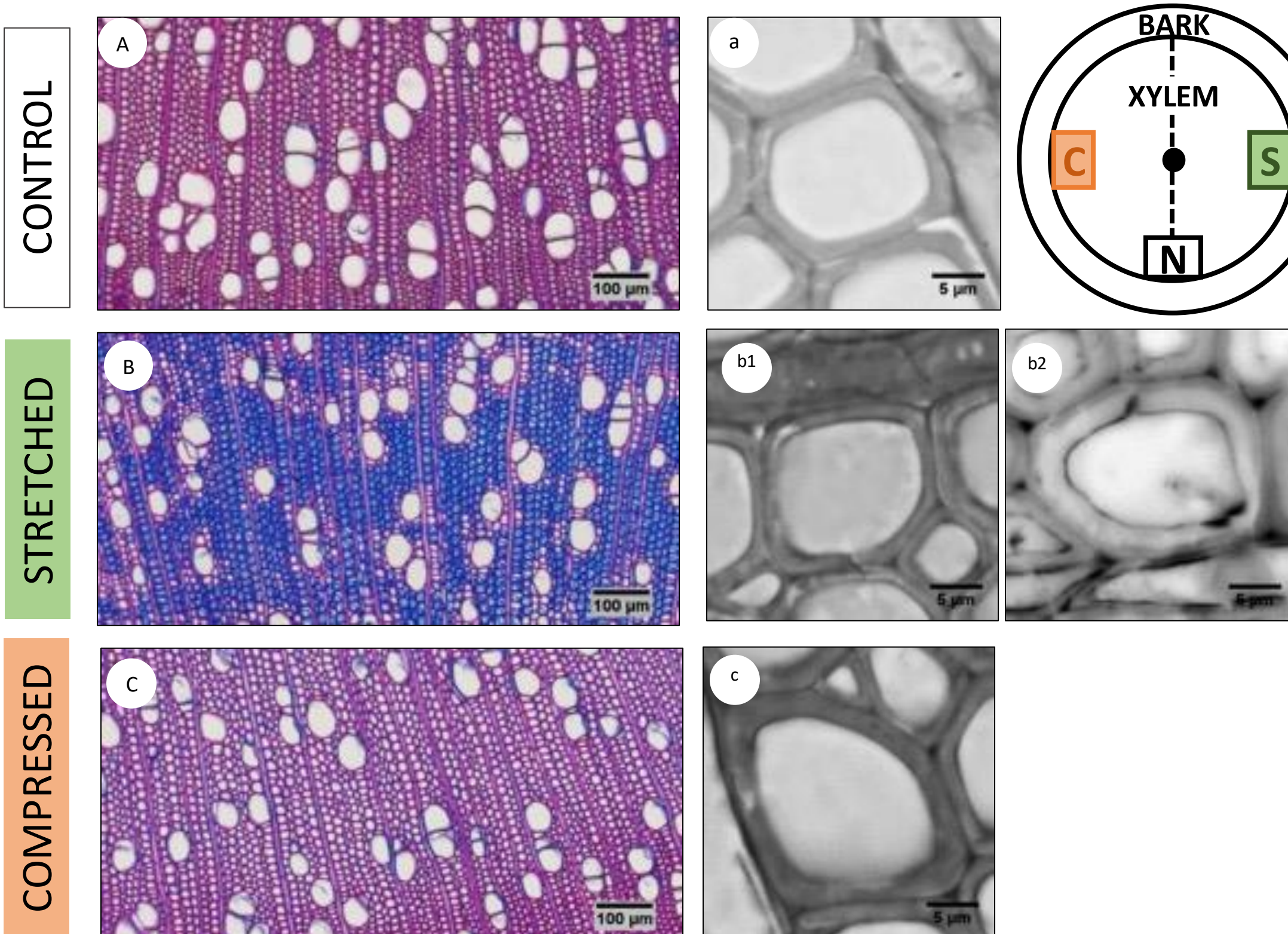
CT (No bending) 3B/w (3 bending / week) 15B/w (15 bending / week)



LOCAL perception of longitudinal strains (3B/w) BUT MORE THAN just the absolute value of longitudinal strain! (15B/w)

The effects of repeated bending on xylem anatomy

Tensile and compressive strains lead to contrasted responses



A, B, C : cross-sections of xylem samples stained with Astra blue-safranin
a, b, c : close-up on fibers
b1 : fibers without G-layer; b2 : fibers with G-layer

15B/w treatment

G-layer = peculiar internal cell wall layer produced by wood fibers in tension wood

FLA = Fasciclin-like arabinogalactan-protein → important for the formation of tension wood

Vessel density: -28%
Vessel diameter: -8%
Fibers with G-layer: S-layer ↓
UP-regulation of the expression of some FLA genes
Fibers without G-layer: S-layer ↑

Vessel density: -25%
Vessel diameter: not modified
Inhibition of G-layer formation
DOWN-regulation of the expression of some FLA genes
S-layer ↑↑

Ability to perceive the SIGN OF THE STRAINS (tensile or compressive strains)

The formation of the secondary cell wall is sensitive to the dose (number) of bending

