

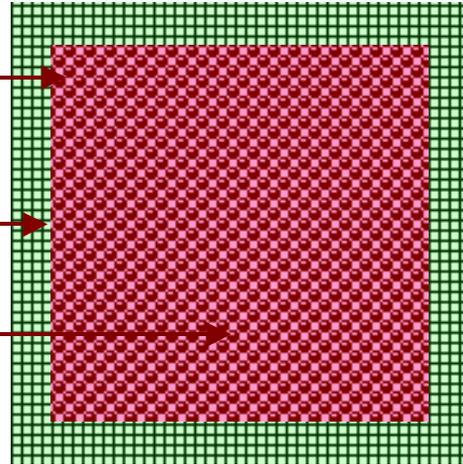
BOUNDARY THICKNESS

HOW THICK A WALL IS NEEDED TO PREVENT MEMBRANE FAILURE FOR PRESSURIZED CELLS?

K_A = AREA MODULUS
 K_V = VOLUME MODULUS

FLUID MEMBRANE

FLUID INTERIOR



FOR SOLIDS

$$K_A \sim K_V d$$

TECHNICAL SPECS: IF

$K_A \sim 5 \text{ J/m}^2$ NEEDED TO SUSTAIN 1 ATMOS.

$K_V \sim 10^9 \text{ J/m}^3$ MODERN BIOMATERIALS

THEN

$$d = 5 \text{ nm}$$

WALLS OF MODERN (G+) BACTERIA ARE 20-80 nm

MEASURED WALLS OF 2 Ga CELLS ARE 200-800 nm

POSSIBLE EXPLANATIONS:

- PRIMITIVE BIOMATERIALS WERE NOT AS STRONG
- MECHANICALLY COMPLEX BOUNDARIES
- "WALL" IS A PRODUCT OF DEGRADATION