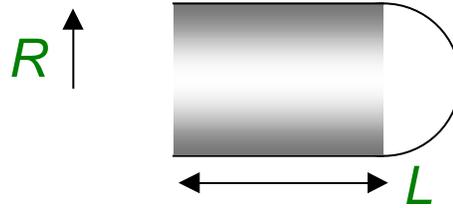# DESIGN: ELLIPSOIDS

CHALLENGE:
BENDING ENERGY INCREASES WITH DISTORTION
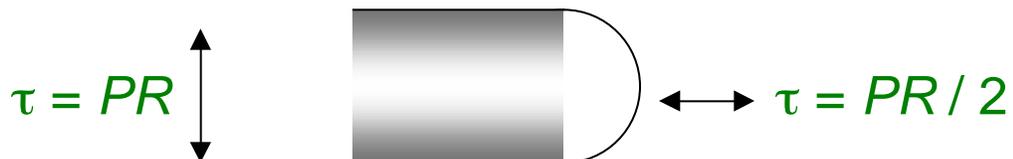

SOLUTION:
MEMBRANES WITH SPONTANEOUS CURVATURE

$$E_{COCCUS} - E_{SPHERE} = \kappa_{BEND} (1 - RC_O)^2 (L/R)$$

VANISHES FOR $C_O = 1/R$
METHOD: LIPID COMPOSITION OR EXCESS OUTER LEAFLET AREA

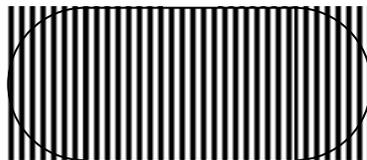## CHALLENGE:
STRESS IS ANISOTROPIC & HIGHER THAN SPHERE

$\tau = PR$

$\tau = PR / 2$

SOLUTION:
MODERN BACTERIA USE ANISOTROPIC CELL WALL STRONGER IN THE HOOP DIRECTION

(COMPLEX CONSTRUCTION; DIFFICULT TO DIVIDE)