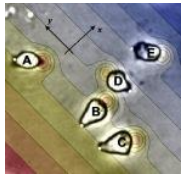
Physics 131-Physics for Biologists I



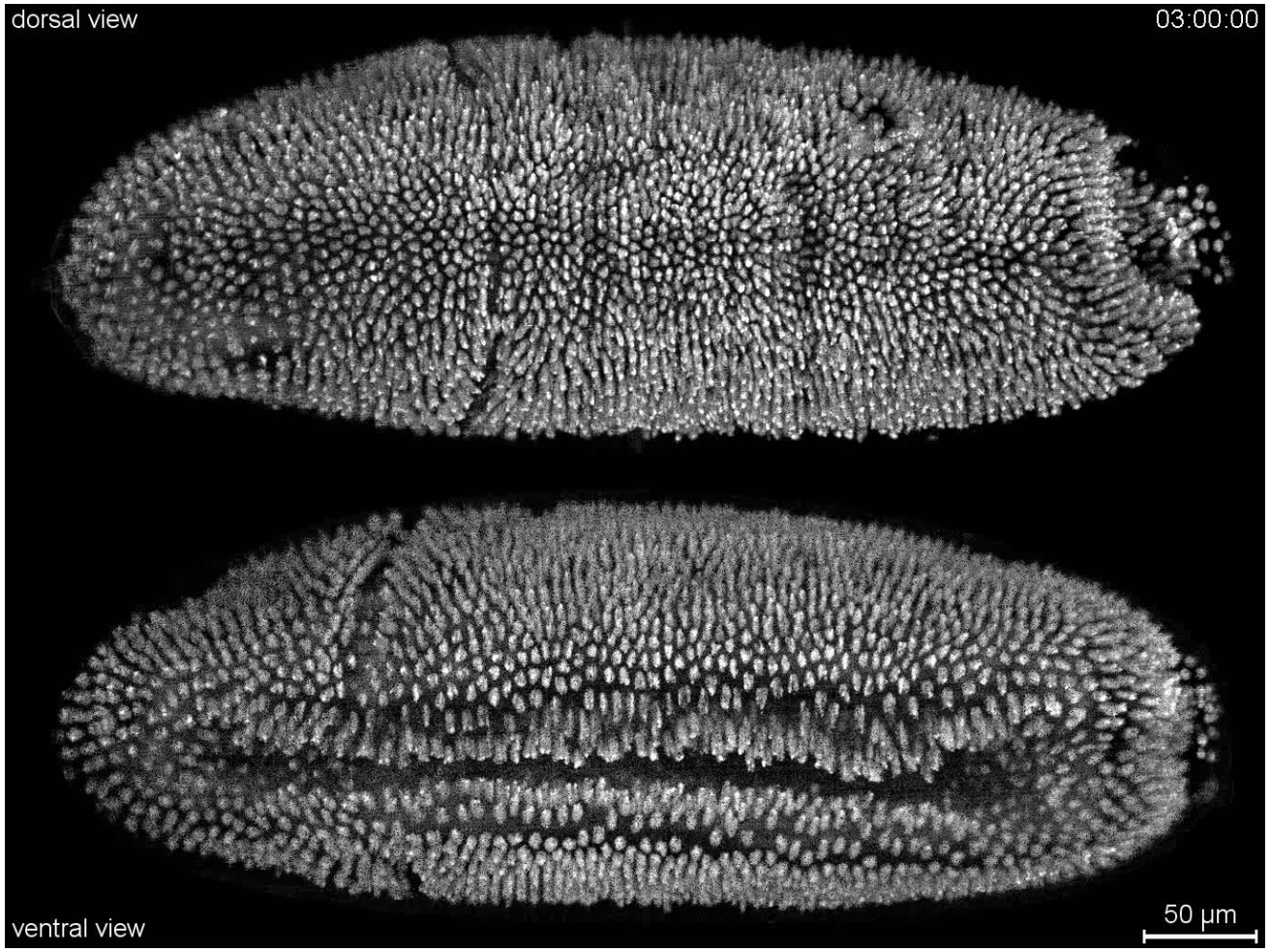
Professor: Wolfgang Losert
wlosert@umd.edu

Today:

Phil Keller
Janelia Farm

4pm
Marker Seminar Room

BIOPHYSICS SEMINAR

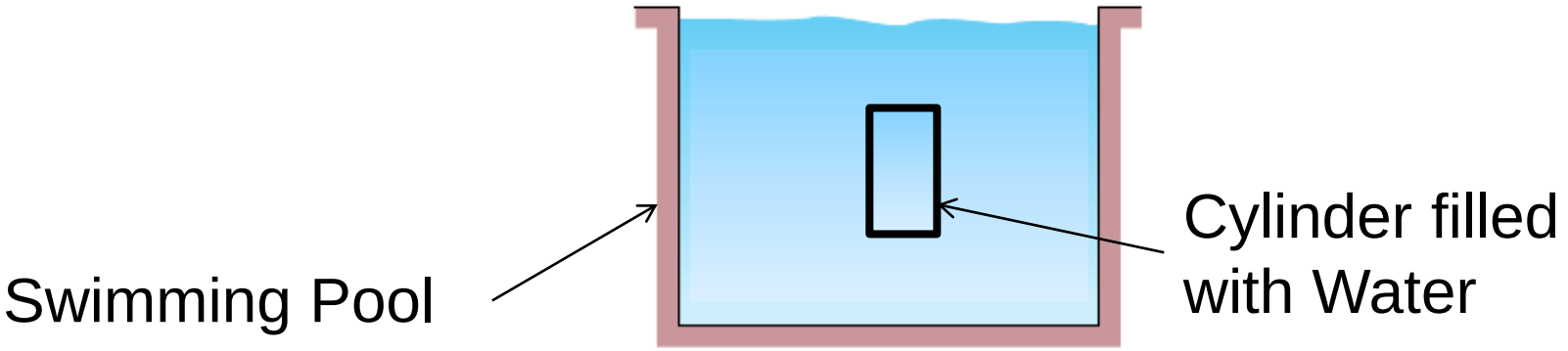


Kinds of Matter

- Classify objects by how they deform and flow when forced!
  - *Solid*: the amount of deformation depends on the applied force. If you stop applying a force, the solid reverts back to its original shape
    - Where have we seen a force that depends on the amount of deformation?
  - *Fluid*: the speed of flow depends on the applied force. A fluid stops deforming if you stop applying a force but it doesn't revert back. Fluids have no shape on their own. Flow to fill a container. (Liquid: Constant volume; Gas: Volume can change)
    - Where have we seen a force that depends on the flow speed

The Pressure in a Fluid increases with Depth
Here we see WHY!

- Draw a free body diagram for the cylinder of water (you can also draw a system schema)



$$W = mg = \rho Vg = \rho Adg$$

$$p_{extra} = \frac{W}{A} = \rho gd$$

Whiteboard, TA & LA

Pressure in a Fluid

- At a boundary or wall, the pressure in a constrained fluid creates a force perpendicular to the surface.

$$\vec{F} = p\vec{A}$$

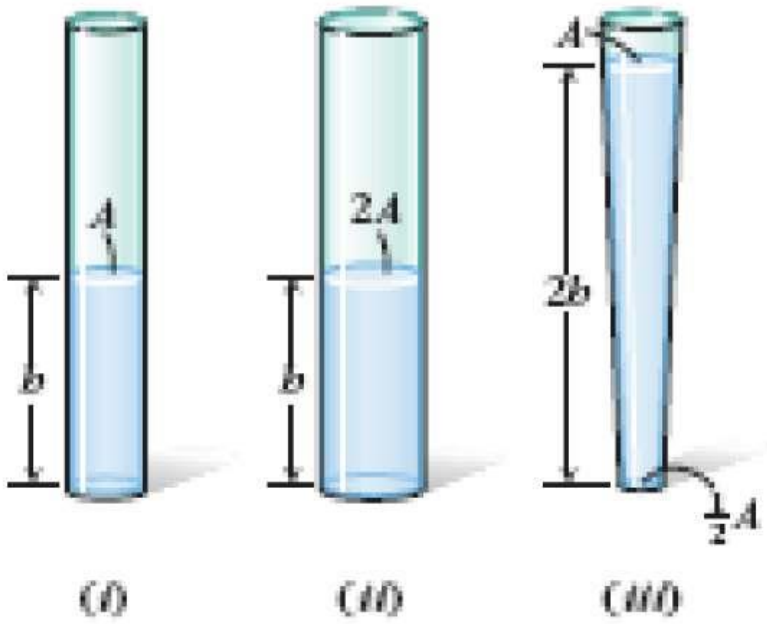
- The constrained fluid has an internal pressure, meaning that it would create a force against any surface placed anywhere inside the fluid in any orientation.
- The pressure in a fluid increases with depth.

$$p = p_0 + \rho g d$$

- When immersed in a fluid, an object feels an (upward) force equal to the weight of the displaced fluid. (Archimedes' Principle)

Consider the containers at right. Which of the following correctly compares the *pressure* (*P*) of the water at the bottoms of the containers?

1. $P_1 = P_2 = P_3$
2. $P_3 > P_1 > P_2$
3. **$P_3 > P_1 = P_2$**
4. $P_2 > P_1 > P_3$
5. $P_1 = P_2 > P_3$
6. Other ranking
7. Not sure



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