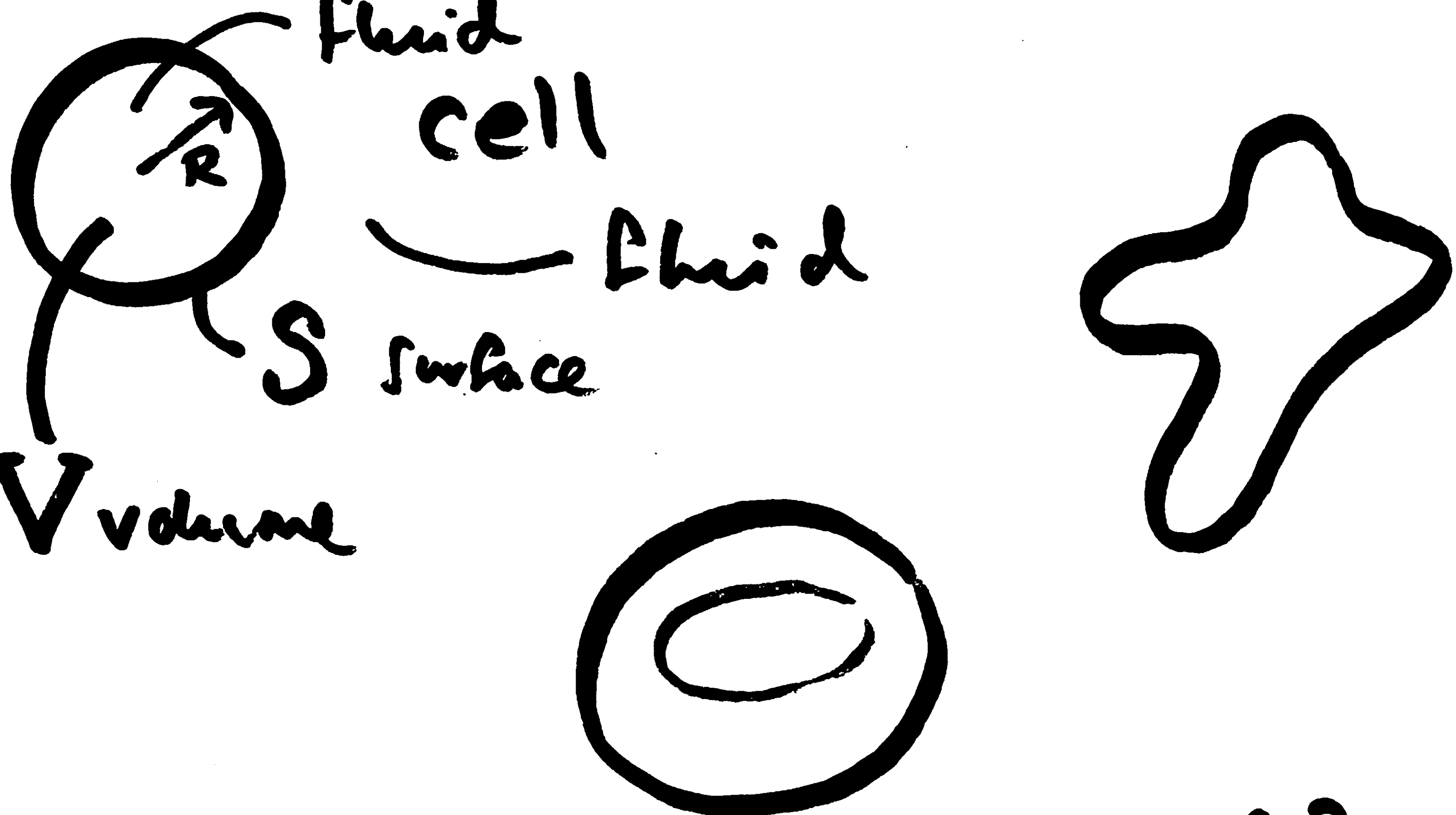
Small is different from big
(cells) (body)
(car)

- surface tension matters
- viscosity matters
- diffusion matters

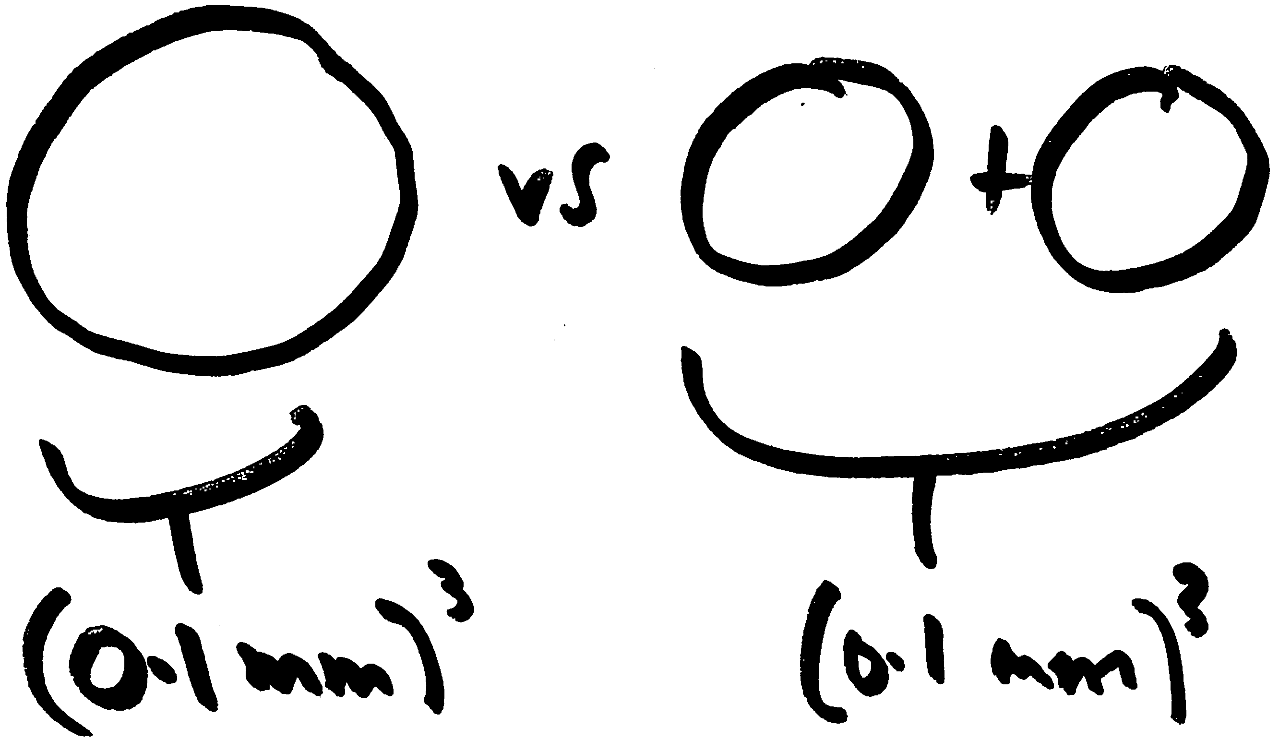


why are raindrops round?
spherical?

Surface area "costs" energy.

$\sigma = \frac{\text{energy}}{\text{area}}$ = surface tension

Compare



$$\frac{\text{energy}}{\text{volume}} = \frac{\text{force}}{\text{area}} = \text{pressure.}$$

$$\frac{\text{energy}}{\text{area}} = \frac{\text{force}}{\text{length}} = \text{surface tension.}$$

$$\frac{\text{energy}}{\text{length}} = \text{force} = \text{tension}$$

continuous media

radius: r

volume: $\frac{4\pi}{3} r^3$

surface area: $4\pi r^2$

cell <u>doesn't</u> <u>burst</u>

absorbs water until the surface is fully <u>tense</u>. → spherical cell.

what is the pressure (P) in the cell?

given r, σ (surface tension)

σ → $\frac{\text{energy}}{\text{area}}$

$P \sim \frac{\text{energy}}{\text{volume}}$

$P = \frac{\sigma}{r}$

make cell a tiny bit larger...

PV → energy → $P \frac{4}{3}\pi r^3$

$\sigma 4\pi r^2$ → energy

$\frac{d(\sigma 4\pi r^2)}{dr} = \sigma 8\pi r$

$\frac{d(P \frac{4}{3}\pi r^3)}{dr} = P 4\pi r^2$

$P = \frac{2\sigma}{r}$