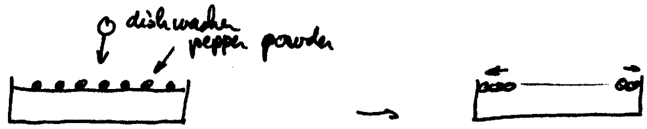
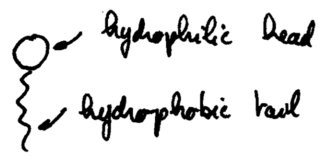
(7) Soap bubbles

7.1 Surfactants

demo :



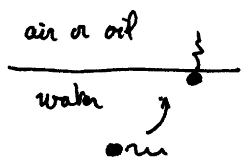
7.1.1 Amphiphile molecules :



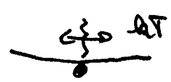
examples : SDS : $CH_3-(CH_2)_{11}-SO_3^{\ominus}\ Na^{\oplus}$ anionic (very common)

CTAB : $CH_3-(CH_2)_{11}-\overset{\oplus}{N}(CH_3)_3$, $Br^{\ominus}$ cationic

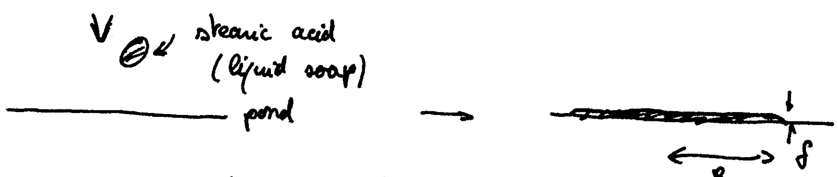
$C_{12}E_5$ $CH_3(CH_2)_{11}(O-CH_2)_5-OH$ non-ionic



⇒ cost less energy to make an interface.

also :  ⇝ wants to move ⇒ need more interface. (surface pressure)

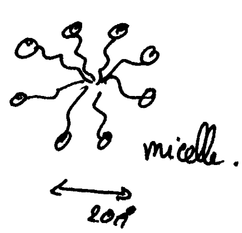
experiment from B. Franklin (~1750)



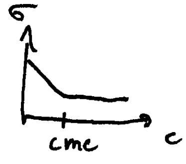
$$\boxed{\frac{V}{R^2} \sim \delta}$$ → measure of a molecular size.

7.1.2 cmc (Critical Micelle Concentration)

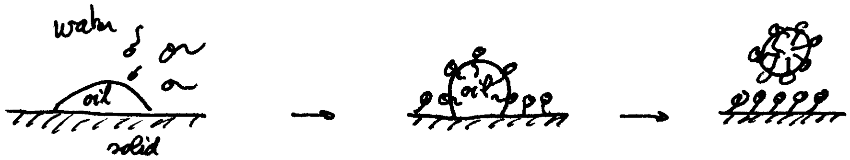
⇝ self assembly if high concentration (c > cmc).



⇝ plot $\sigma(c)$



7.1.3 Detergency

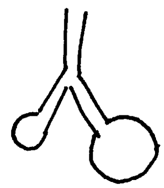


↝ hydrophilic core around the dust.

⇒ stabilization of emulsions.

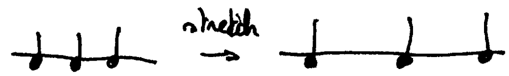
7.1.4 Marangoni effect

→ pb: filling lungs:



$\Delta P \sim \frac{\sigma}{R}$ ⇒ easier to fill the bigger.

with surfactants:



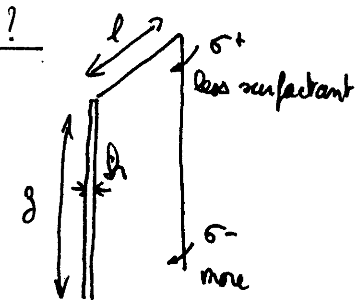
$\Rightarrow \sigma \nearrow$.

$\Delta P \sim \frac{\sigma \nearrow}{R \nearrow}$ ~ constant allow to breath.

↝ premature babies → sprays with surfactants.

7.2 Soap bubbles

why soap?



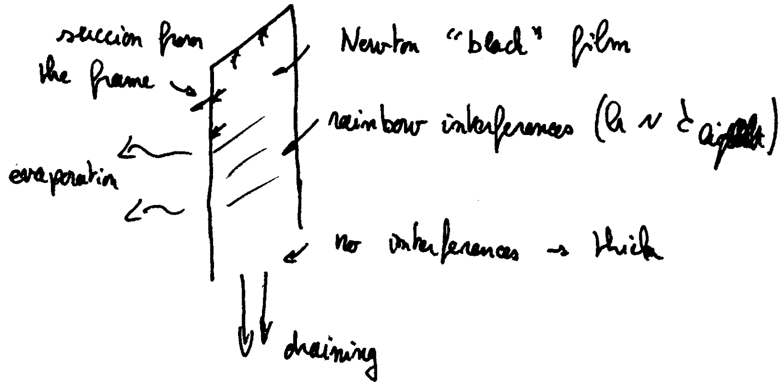
$\rho g h l dz = l . d\sigma$

$$\Rightarrow \boxed{z \sim \frac{\Delta\sigma}{\rho g h}}$$

$\begin{cases} \Delta\sigma \sim 50 \text{ mN/m} \\ h \sim 10 \mu m \end{cases}$

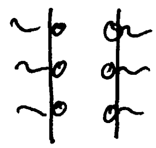
→ $z \sim 50$ cm.

Colours of a soap film:



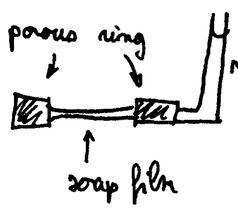
slide: J. Bush

↳ black film region



→ $h < 100\,nm$ ⇒ van der Waals.

↳ way of measuring microscopic forces.



tube → level ⇒ ΔP.

⇒ measure $\Delta P(h)$. (V. Bergeron).