VISCOMERTRY

What is viscosity

- **Viscosity** is a measure of the resistance of a fluid which is being deformed by either shear stress or tensile stress.

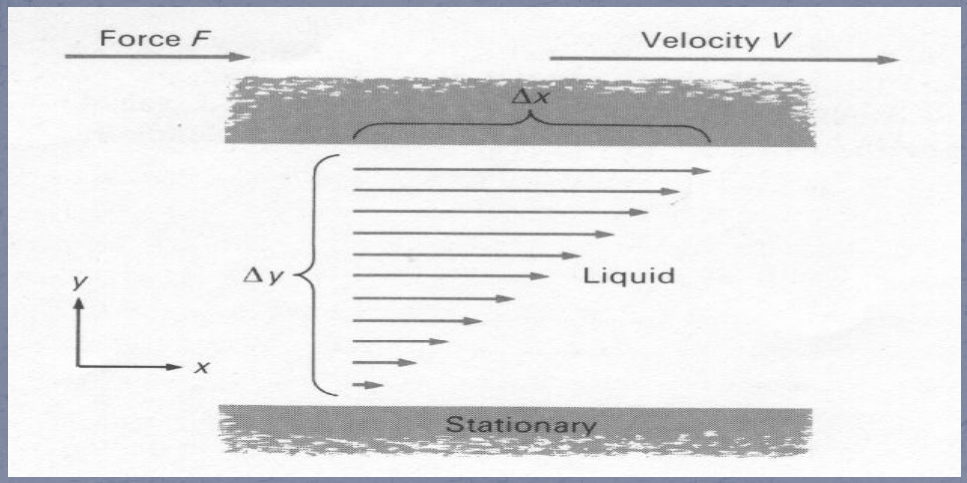
Example:

- viscosity is "thickness" or "internal friction".
- water is "thin", having a lower viscosity
- honey is "thick", having a higher viscosity

- the less viscous the fluid is, the greater its ease of movement (fluidity)

Definition of viscosity:

Viscosity describes a fluid's internal resistance to flow and may be thought of as a measure of fluid friction



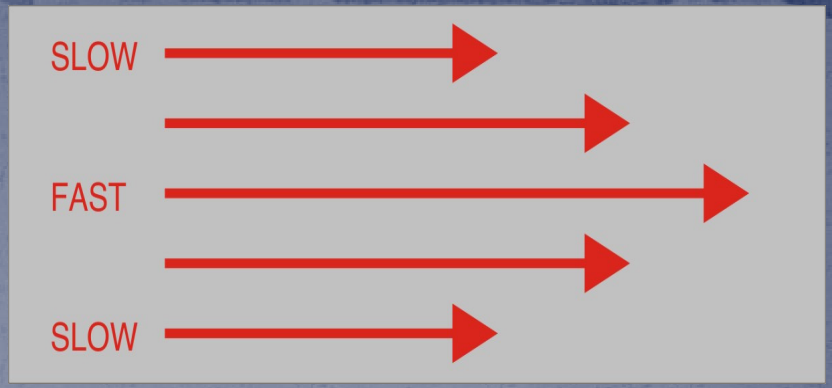
For normal (Newtonian) flow behaviour:

$$\eta = \tau/(dv/dy)$$

units: $(dyn/cm^2)/sec^{-1}$

At 20.0°C, η(water) ~ 0.01P

➢ When a fluids moves slowly, its flow is orderly and we call it **LAMINAR FLOW**,



➢ Fast moving fluids do not flow orderly – the streamlines become chaotic & unstable, producing **TURBULENT FLOW**

This creates friction, and this increases if a liquid is more viscous. The flow forms loops, whirls and eddies, wasting energy, causing more ‘drag’ and heating the fluid up:

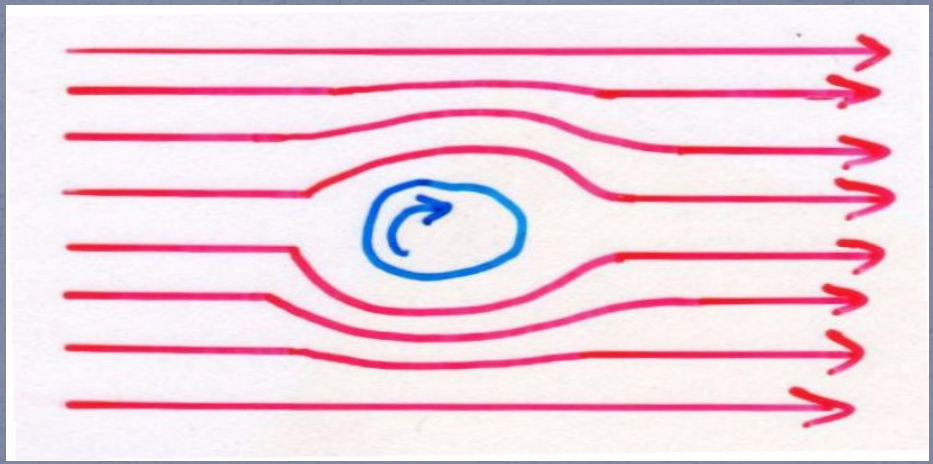
Viscosity of bio molecules

Why viscometry?

- Simple, straightforward technique for assaying
- Solution conformation of biomolecules & volume/ solvent association
- Molecular weight of biomolecules
- Flexibility of biomolecules

Viscosity of biomolecular solutions:

A dissolved macromolecule will INCREASE the viscosity of a solution because it disrupts the streamlines of the flow:



Relative viscosity - $h_r = h/h_o$

Reduced viscosity - $\mathbf{h_{red} = (h_r - 1)/c}$

Intrinsic Viscosity [h] - $[h] = \mathrm{Lim}_{c \to o} (h_{red})$

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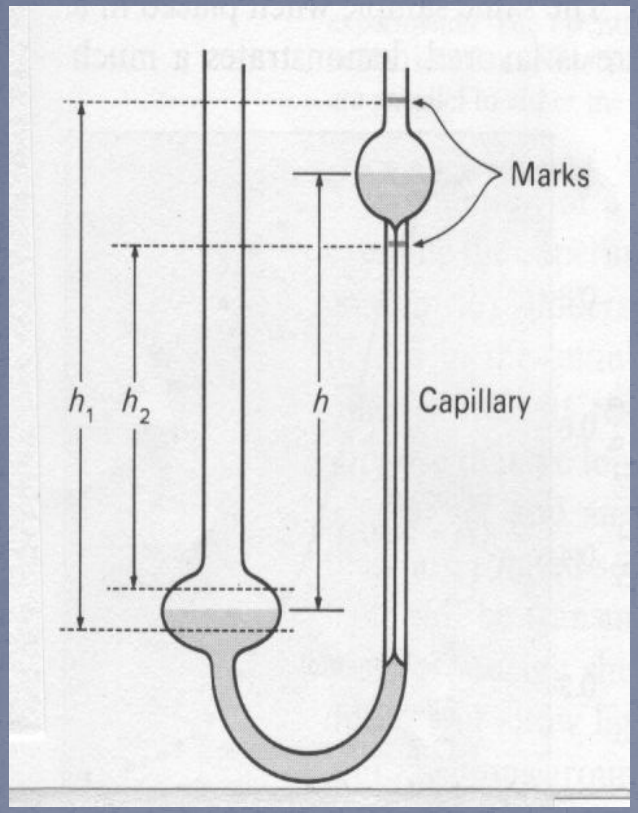
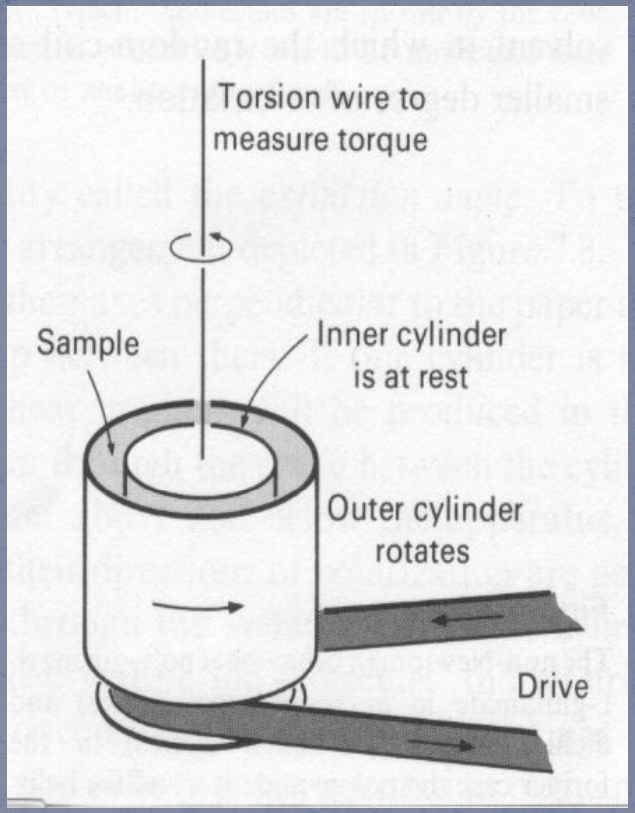
- **Types of Viscometer:**





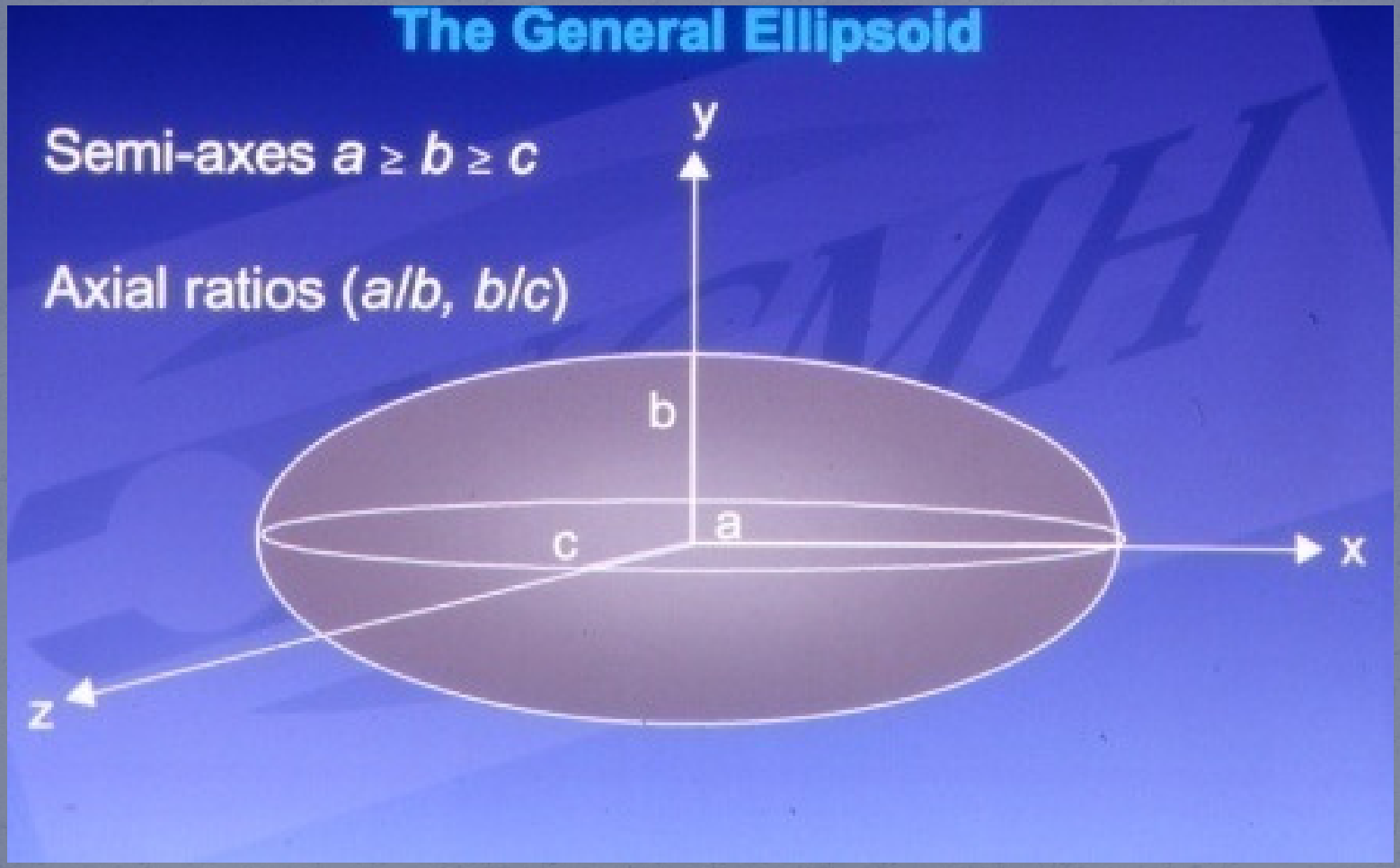
1. "U-tube" (Ostwald or Ubbelohde)

2. "Cone & Plate" (Couette)

The Physical Basis of Viscosity

- Viscosity is a measure of the ease with which molecules move past one another
- It depends on the attractive force between the moleculees
- It depends on whether there are structural features which may cause neighboring molecules to become "entangled"
- Viscosity decreases with increasing temperature - the increasing kinetic energy overcomes the attractive forces and molecules can more easily move past each other

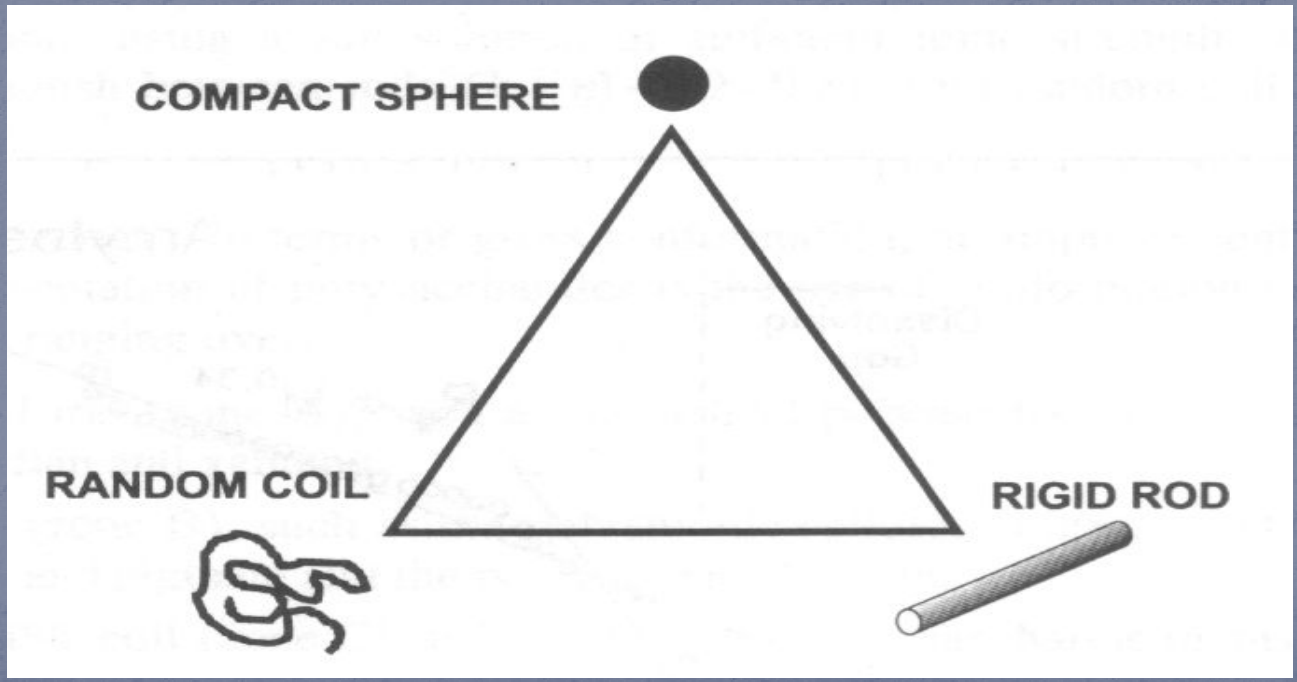
Getting a shape from the viscosity ν parameter



Computer program ELLIPS2 downloadable from www.nottingham.ac.uk/ncmh

GENERAL CONFORMATIONS

The three extremes of macromolecular conformation (COMPACT SPHERE, RIGID ROD, RANDOM COIL) are conveniently represented at the corners of a triangle, known as the HAUG TRIANGLE:



Conclusion :

- Thereby using the measurement of resistance of a fluid which is being deformed by either shear stress or tensile stress

- We could derive the conformation of the molecules by means of viscosity

Thanking You