J FERRER

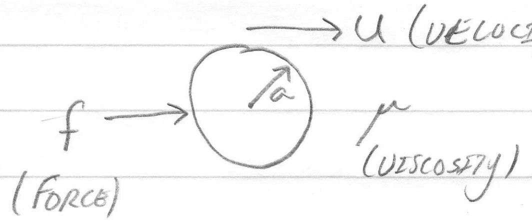
CONTINUATION FROM MORNING SESSION

GEM4 8/15/06

FLUCTUATION DISSIPATION THEORY

→ TRACK CENTROID OF BEAD ATTACHED TO CELL SURFACE

BEADS "STALL AND HOPS"



$\boxed{f = 6\pi a \mu U}$ STOKES LAW

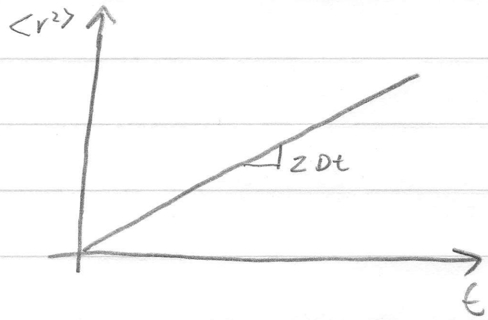
$D = l^2/\tau$ ← MEAN FREE TIME

(l ← MEAN FREEPATH; D ← DIFFUSION CONSTANT)

$\frac{1}{2} m \langle U^2 \rangle = \frac{1}{2} K_B T \implies 6\pi a \mu D = K_B T$

EXAMPLE : $M_w \sim a^3$, $D \sim M_w^{-1/3}$ ⇒ TRUE IF $M_w > 1000$

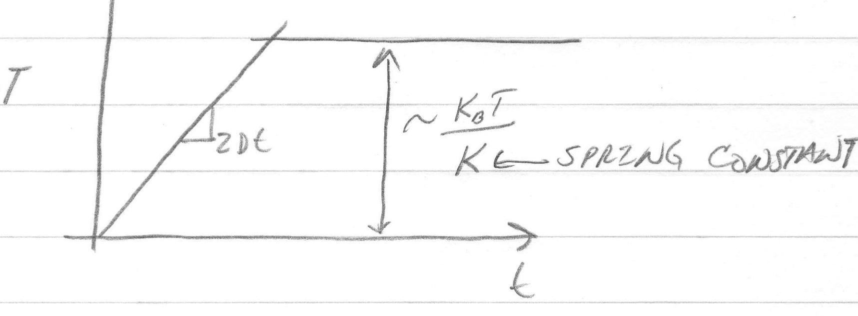
EXAMPLE : $\mu = K_B T / 6\pi a D$



EXAMPLE 3 : GENERALIZED (MASON & WEITZ, 1995)

DIFFUSION ⇒ VISCOELASTIC MEDIA AT THERMODYNAMIC EQ.

$\pi a s G(s) \langle \Delta r^2(s) \rangle = K_B T$



$$\underbrace{F(\omega)}_{\text{AGITATION}} = \underbrace{2K_BT\,G''(\omega)/\omega}_{\text{THERMAL HITS}} + \underbrace{\Delta(\omega)}_{\text{MOTOR HITS}}$$

} TAKES INTO ACCOUNT OTHER EFFECTS IN CELL (ATP)

$$\Delta(\omega) \sim \omega^{-\gamma} \quad (\gamma = 2)$$

$$G^* \sim (j\omega)^{x-1}$$

FOCAL ADHESION

→ CONNECTION BETWEEN ECM AND CYTOSKELETON

→ CELL CAN SENSE ITS ENVIRONMENT AND RESPOND TO IT.

2D VS. 3D ⇒ CHANGE THE STRUCTURE OF FOCAL ADHESIONS

BIOMECHANICS AT ALL LENGTH SCALES — R.D. KAMM (MIT)

MECHANOTRANSDUCTION ⇒ SENSING FORCE AND CONVERTING IT INTO A BIOCHEMICAL RESPONSE

HOW DOES THIS HAPPEN?

→ NOT COMPLETELY UNDERSTOOD, SEVERAL HYPOTHESES.

FORCE LEVELS FOR MOLECULAR UNFOLDING - UNBINDING : 10 - 100 pN

MOLECULAR DYNAMICS ⇒ SIMULATE WHAT MAY HAPPEN AS FORCES ARE APPLIED TO MOLECULES AND INDUCE CONFORMATIONAL CHANGES

UNDERSTANDING THE PRINCIPLES THAT GOVERN ADAPTIVE IMMUNE SYSTEM — DR. ARUP CHAKROBORTY (MIT)

T-CELLS ⇒ DEAL WITH PATHOGENS
↳ ORCHESTRATE THE ADAPTIVE IMMUNE SYSTEM

THERE ARE MOLECULAR SIGNATURES INDICATING THE PRESENCE OF PATHOGENS. THESE SIGNATURES CAN BIND TO T-CELL RECEPTORS AND ACTIVATE THE T-CELL RESPONSE.

HOW DOES T-CELL DISCRIMINATE BETWEEN "SELF" AND "NON-SELF"?

T-CELL CAN DETECT 10 ANTIGENS OUT 30,000 ENDOGENOUS MOLECULES
↳ HIGH SENSITIVITY AND SPECIFICITY

COOPERATIVITY BETWEEN ANTIGEN AND ENDOGENOUS PEPTIDES!!
(MODEL)