

GEM 4

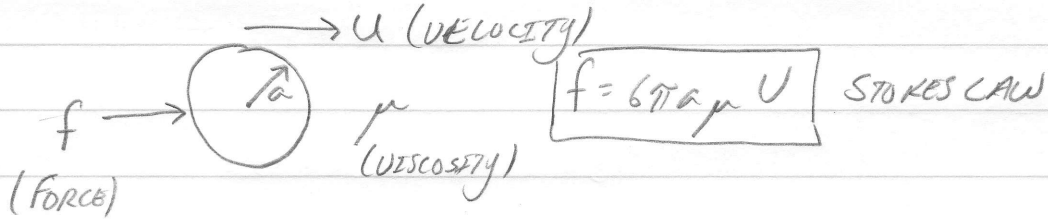
8/15/06

CONTINUATION FROM MORNING SESSION

FLUCTUATION DISSIPATION THEORY

→ TRACK CENTROID OF BEAD ATTACHED TO CELL SURFACE

BEADS "STALL AND HOPS"



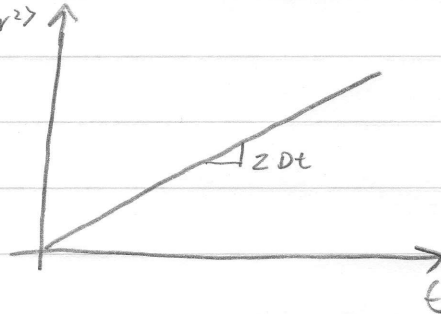
↓ MEAN FREEPATH

$D = l^2 / \tau$  ← MEAN FREE TIME  
 ↑ DIFFUSION CONSTANT

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

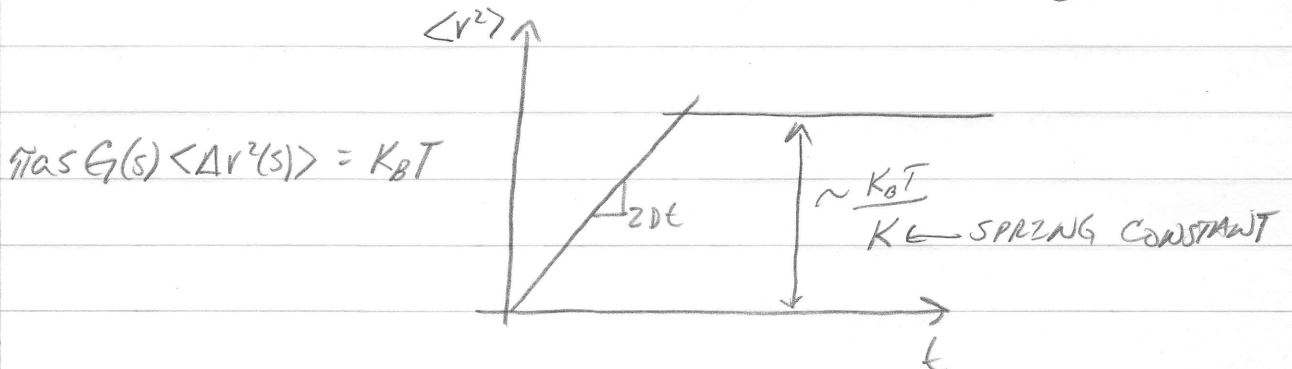
EXAMPLE:  $M_w \sim a^3$ ,  $D \sim M_w^{-1/3} \implies$  TRUE IF  $M_w > 1000$

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



EXAMPLES: GENERALIZED (MASON & WEITZ, 1995)

DIFFUSION  $\implies$  VISCOELASTIC MEDIA AT THERMODYNAMIC EQ.



$$F(\omega) = \underbrace{2k_B T \zeta''(\omega)}_{\text{AGITATION}} / \omega + \underbrace{\Delta(\omega)}_{\text{MOTOR HITS}}$$

$\zeta^* \sim (j\omega)^{\alpha-1}$

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

} TAKES INTO ACCOUNT OTHER EFFECTS IN CELL (AFP)

## 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  $\Rightarrow$  DEAL WITH PATHOGENS

$\hookrightarrow$  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  $10^7$  <sup>ANTIGENS</sup> OUT  $30,000$  <sup>ENDOGENOUS</sup> MOLECULES

$\hookrightarrow$  HIGH SENSITIVITY AND SPECIFICITY

COOPERATIVITY BETWEEN ANTIGEN AND ENDOGENOUS PEPTIDES !!  
(MODEL)