**GEM4**

**FLUCTUATION-DISSOLUTION THEORY**

→ TRACK CENTROZOID OF BEAD ATTACHED TO CELL SURFACE

BEADS "STILL AND HOPS"

→ \( U \) (VELOCITY)

\[
f = 6 \eta R U \quad \text{STOKES LAW}
\]

(Force)

\[
\frac{1}{2} m \langle U^2 \rangle = \frac{1}{2} k_B T \quad \Rightarrow \quad \langle v^2 \rangle = \frac{k_B T}{m}
\]

**EXAMPLE:** \( M_w \sim a^3 \quad D \sim M_w^{1/4} \quad \Rightarrow \text{TRUE IF } M_w > 1000 \)

**EXAMPLE:** \( \mu = k_B T / 6 \eta a D \quad \langle v^2 \rangle \)

**EXAMPLE:** GENERALIZED (MASS \& WEIZEN, 1995)

DIFFUSION \( \Rightarrow \) VISCOELASTIC MEDIA AT THERMODYNAMIC EQ.

\[
\mu \dot{\gamma}(s) \langle \Delta v^2(s) \rangle = k_B T
\]
\[ F(\omega) = 2k_B T G''(\omega) / \omega + \Delta(\omega) \]

\[ G'' \sim (\omega) \]

\[ \Delta(\omega) \sim \omega^{-\kappa} \quad (\kappa = 2) \]

\[ \text{TALES INTO ACCOUNT OTHER EFFECTS IN CELL (AMP)} \]

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**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*

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**Biomechanics at all length scales — R. D. Kamal (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
• Orchestrates 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 10^11 out 30,000 self molecules
• High sensitivity and specificity

Cooperativity between antigen and endogenous peptides!

(model)