GENERAL SESSION

GENERALIZATION OF FORCE: POLYMERIZATION OF ACTIN
- Dr. Wonmuk Wang (Texas A&M)

CAMELLIPODEUM, FILLOPODIUM

SHEET-LIKE       FINGER-LIKE

BRANCHED NETWORK       BUNDLES OF
OF F-ACTIN       F-ACTIN

IN CAMELLIPODEUM THERE IS CONSTANT ACTIN TURNOVER

- OLDER FILAMENT DISASSEMBLE
- MONOMERS ARE TRANSPORTED TO LEADING EDGE
- MONOMERS INTEGRATE INTO EXISTING FILAMENT
  "PUSHING" THE MEMBRANE

- BROWNIAN RATCHET MODEL (MOGILNER & OSTER, 1996)
  
  
  FILAMENT FLUCATIONS + ADDITION OF MONOMERS AT
  THE TIP OF FILAMENT = POLYMERIZATION FORCE GENERATION

  IMPORTANT FACTORS: LOAD, ANGLE OF FILAMENT RELATIVE TO LOAD

  \[ \theta \]

  HIGH LOAD \( \rightarrow \theta \approx 90^\circ \)

  LOW LOAD \( \rightarrow \theta \approx 0^\circ \)

IN MOTOR PROTEINS: BROWNIAN RATCHET VS POWER STROKE

- MYOSIN
- KINESIN
KINESIN \( \rightarrow \) MOLECULAR TRANSPORTER

1 ATP/step, step size = 8.3 nm

HAND-OVER-HAND?

How does it generate a step from ATP hydrolysis?

KINESIN DILEMMA

- SMALL CONFORMATION CHANGE (\( \sim \) \( A \)) \( \rightarrow \) LARGE MOTION (\( \sim \) nm)
- NECK LINKER - MOTOR HEAD BINDING

ATP BINDING INDUCES CONFORMATIONAL CHANGE
THAT PROPAGATES THROUGH MOLECULE LEADING TO STEP.

It is not ATP hydrolysis what provides the energy.

CYtoskeleton DYNAMICS SIMULATION OF RED BLOOD CELL

- DR. Ju Li

THE SPECTRIN NETWORK STABILIZES THE SHAPE OF RBC
INTO THE BI-CONCAVE GEOMETRY.

UNDER CERTAIN CONDITIONS (ENERGY), A SIMULATED
SPECTRIN NETWORK WILL FORM A STABLE BI-CONCAVE
GEOMETRY
MECHANICS OF NEUTROPHIL RESPONSE TO DEFORMATION: AN EXAMPLE OF MULTI-SCALE MODELING
- Dr. Roger Kamm (MIT)

ORGANISM → ORGANS → CELL → MOLECULE

PULMONARY CIRCULATION → MANY DISEASES RELATED TO IT
MODEL BUILT ON "REAL" MORPHOLOGICAL AND PHYSIOLOGICAL DATA.

MODELED NEUTROPHIL WITH MAXWELL MODEL ⇒ SIMPLISTIC COMPARED TO RECENT DATA, BUT CAN CAPTURE THE DESIRED BEHAVIOR

ACTUAL EXPERIMENTS LOOKING AT NEUTROPHILS ENTERING A NARROW CHANNEL ⇒ BEHAVIOR INDEPENDENT OF TEMPERATURE NEUTROPHILS LOSE SOME OF ITS ELASTICITY RIGHT AFTER ENTERING THE CHANNEL BUT RECOVERS AFTER ~30 SEC THIS RESULT CORRELATED WITH FACTORS CONTENT

SCALING UP → MOLECULES → NETWORK MODELING → CELL LEVEL