MOTOR TEAMS : A CELL BIOLOGY PERSPECTIVE

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Molecular Machines at work inside a cell

Rotary ATPases DNA machines Polymerization Membrane deformation Cell-Cell adhesion Linear Motors ...

Molecular Forces 1-10 pN

Cellular Forces 10 -1000 pN

Heterogeneous, Difficult to measure

Contribution of individual molecules?



Microtubule Motors



Inner Life of the Cell

Kinesin and Dynein at Work ...





Deacon et al







Motion of Lipid droplets in Drosophila embryos



Welte et al, 1998, Gross et al, 2002

Tug-of-war as a cooperative mechanism for bidirectional cargo transport by molecular motors

Melanie J. I. Müller*, Stefan Klumpp[†], and Reinhard Lipowsky^{*†} PNAS | March 25, 2008



- Stochastic transitions between two species of motor yields Bidirectional motion
- Tuning of single-motor parameters
- No need to invoke a third "coordination complex"

Tug-of-war between dissimilar teams of microtubule motors regulates transport and fission of endosomes

Virupakshi Soppina, Arpan Kumar Rai, Avin Jayesh Ramaiya, Pradeep Barak, and Roop Mallik¹

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Edited by J. Richard McIntosh, University of Colorado, Boulder, CO, and approved September 14, 2009 (received for review June 12, 2009)

PNAS, 2009



5.5 pN

1.1 x 5 = 5.5 pN

Kinesin motors have a problem working together

Biophysical Journal Volume 99 November 2010 2967-2977

Two Kinesins Transport Cargo Primarily via the Action of One Motor: Implications for Intracellular Transport

D. Kenneth Jamison,[†] Jonathan W. Driver,[†] Arthur R. Rogers,[‡] Pamela E. Constantinou,[†] and Michael R. Diehl^{†‡}*







iBiology.org, Ron Vale



It's Gear may help Dynein to work in Large Teams



Arpan Rai *et al*, Cell (2013) Mallik et al, Nature (2005)

Teamwork in Motors. A Matter of Life and Death ...



Ashim Rai et al, Cell (2016)

Thanks to my team of Motors ... Priyanka Rai, Mukesh Kumar, Divya Pathak, Kritika Sadh, Ashwin Dsouza, Paulomi Sanghavi, Jagjeet Singh, Aditya Chhatre

We are funded by TIFR-DAE and the Wellcome-DBT India Alliance

