Massachusetts Institute of Technology
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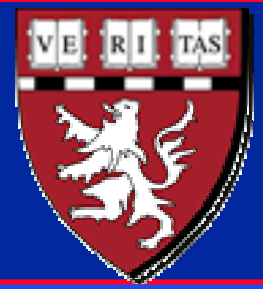

2.785j/3.97J/BEH.411/HST523J

UNIT CELL PROCESSES
Contraction, Migration, and Actin-Myosin Mechanisms Responsible for Generating Force

M. Spector, Ph.D. and I.V. Yannas, Ph.D.

Chondrocytes (Passage 2 Canine) in a Type I Collagen-GAG Matrix

J. Cheng

UNIT CELL PROCESSES

- Mitosis
- Migration
- Synthesis
- Contraction
- Endocytosis
- Exocytosis

Chondrocytes (P2 Canine) in a Type I Collagen-GAG Matrix: Contraction

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40 min

300 min

B. Kinner, in *JM Zaleskas Biomat.* 2004;25:1299

Chondrocytes (P2 Canine) in a Type I Collagen-GAG Matrix: Migration and Contraction

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B. Kinner, in *JM Zaleskas Biomat.* 2004;25:1299

Video of cell wrinkling (contraction) of flexible substrate.

http://www.jcb.org/cgi/content/full/jcb.200201049/DC1/1

B Hinz, *Mol Biol Cell* 12:2730 (2001)
On Web Site

Video of cell wrinkling (contraction) of flexible substrate.

http://motility.york.ac.uk/cells.shtml

TR Fray, *et al.*, *Tissue Eng* 4: 281 (1998)

Dynamics of actin filaments during cell division.

http://ylwang.umassmed.edu/video/cka.htm

L.-g. Cao and Y.-l Wang, *J. Cell Biol*. 111:1905 (1990)

UNIT CELL PROCESSES

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- Exocytosis

Chondrocytes (P2 Canine) in a Type I Collagen-GAG Matrix: Migration and Contraction

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B. Kinner

Video of cell migration through a collagen gel.

http://www.jcb.org/cgi/content/full/jcb.200209006/DC1/1

Wolf, *et al.*, *J Cell Biol* 10:1083 (2002)

Guidance of cell migration by mechanical interactions.

http://ylwang.umassmed.edu/video/guidance.htm

C.-M. Lo, *et al*., *Biophys. J*. 79:144 (2000)

Migration of gerbil fibroma cells.

http://www.jcb.org/cgi/content/full/jcb.200306172/DC1/3

Totsukawa, *et al.*, *J Cell Biol* 10:1083 (2003)

Cell migration in a wound healing assay *in vitro.*

http://www.cellbioed.org/articles/vol2no4/article.cfm?articleID=75

C Watters, *Cell Biol Educ* FEATURE 2 :210 (2003)

Image removed for copyright reasons.
See Figure 6 in Mitchison and Cramer. “Actin-Based Cell Motility and Cell Locomotion.” *Cell* 84:371 (1996)

Two Models for Generation of Traction Force Using Myosin II Activity
In the contraction model (A), myosin pulling on filaments of opposite polarity creates a cortical tension that pulls the cell equally in all directions. This contraction can be converted into movement by combining it with preferential assembly of the cortex at the front of the cell and disassembly at the back, and/or by regulating the relative strength of adhesive contacts to the substratum at the front and back. In the transport model (B), myosin activity pulls the body of the cell over an oriented track of actin filaments attached to the substratum.

Assembly and disassembly of actin

Images removed for copyright reasons.
See Figures 4 and 6 in Stossel, T.P. “On the Crawling of Animal Cells.” *Science*, New Series, Vol. 260, No. 5111. (May 21, 1993), pp. 1086-1094.

Operation of the actin cycle in the lamella of a crawling cell

Proteins mediating the connections between the plasma membrane and actin filaments and between actin filaments in motile cells

Images removed for copyright reasons.
See Figure 3 in Stossel, T.P. “On the Crawling of Animal Cells.” *Science*, New Series, Vol. 260, No. 5111. (May 21, 1993), pp. 1086-1094.

TP Stossel, *Sci* 260:1086 (1993)

Diagram removed for copyright reasons.

Figure 2, "Schematic representation of the modulation of microvascular endothelial cell phenotype during angiogenesis." In Madri, *Kidney Int.* 41:562 (1992)

UNIT CELL PROCESSES

Actin-Myosin Dynamics

Cryo-electron tomography image of the actin in a cell.
Actin (red), membrane (blue), and ribosomes green.
O Medalia, *Sci*. 298:1209 (2002)

Photos removed for copyright reasons.

Actin network in the peripheral lamella of a rabbit lung macrophage.

Photo removed for copyright reasons.
See Figure 2 in Stossel, T.P. “On the Crawling of Animal Cells.”
Science, New Series, Vol. 260, No. 5111. (May 21, 1993), pp. 1086-1094.

TP Stossel, *Sci* 260:1086 (1993)

Muscle myosin “walking” on an actin filament.

http://www.sciencemag.org/feature/data/1049155s1.mov

Vale *Sci* 288:88 (2000)

Kinesin walking on a tubulin microtubule.

http://www.sciencemag.org/feature/data/1049155s2.mov

Vale *Sci* 288:88 (2000)

Motion of myosin V molecules on actin.

http://www.leeds.ac.uk/bms/research/muscle/myosinv/main.htm

L Matthew, et al., *Nature* 405:804 (2000)