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Source: Jain, Rakesh K. "An indirect way to tame cancer."
Scientific American 310, no. 2 (2014): 46-53.

MEDICINE

An Indirect Way to Tame Cancer

Cells and a stiff material called the matrix can squeeze blood vessels in tumors and thus block delivery of cancer-fighting drugs to malignant cells. Now researchers may have a way to reopen vessels and restore the drugs' power

By Rakesh K. Jain

Illustration by Brian Stauffer

Rakesh K. Jain
Scientific American
2014

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Source: Jain, Rakesh K. "An indirect way to tame cancer."
Scientific American 310, no. 2 (2014): 46-53.

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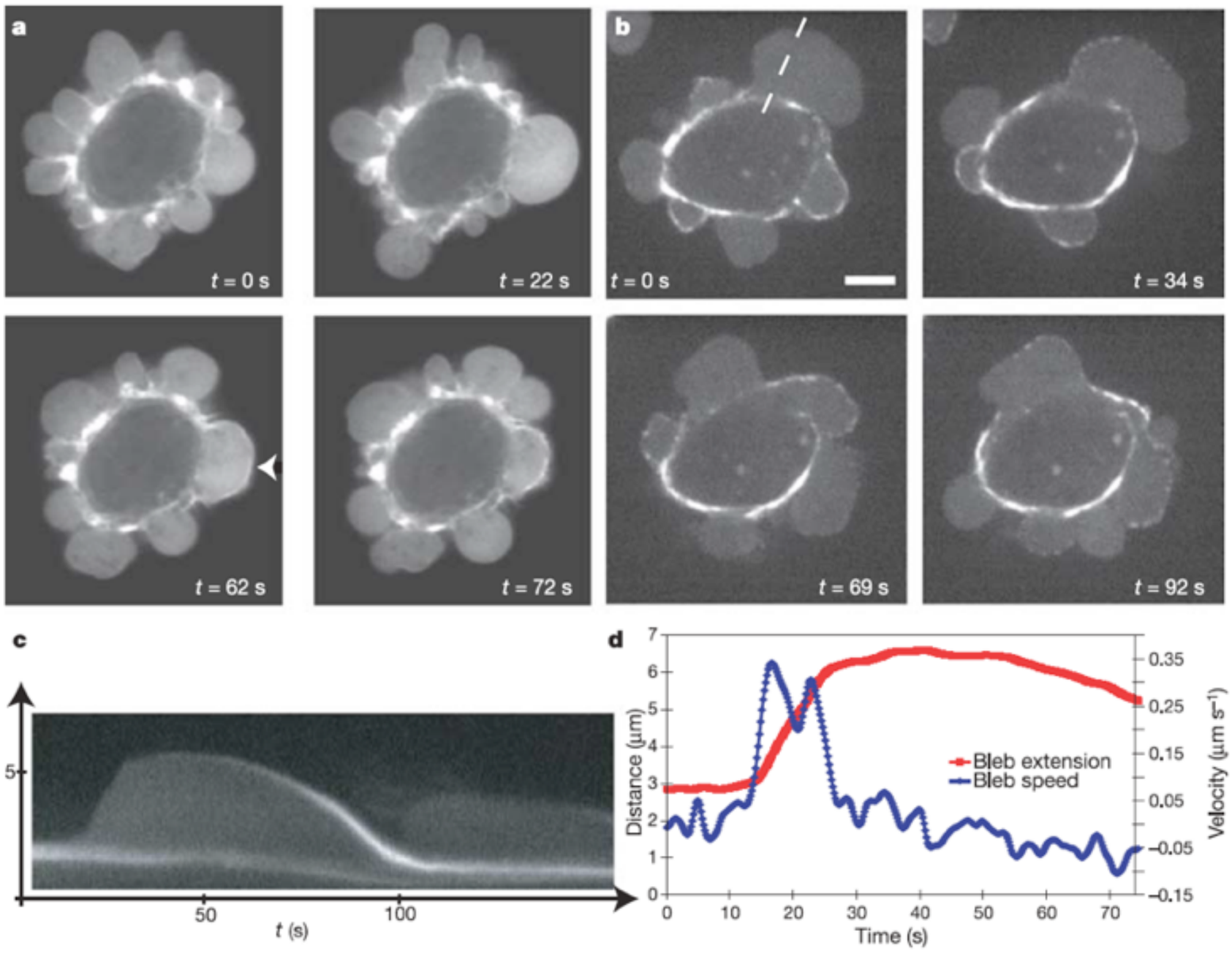
Scientific American 310, no. 2 (2014): 46-53.

Non-equilibration of hydrostatic pressure in blebbing cells

Guillaume T. Charras[1], Justin C. Yarrow[1], Mike A. Horton[2], L. Mahadevan[1,3,4] & T. J. Mitchison[1]

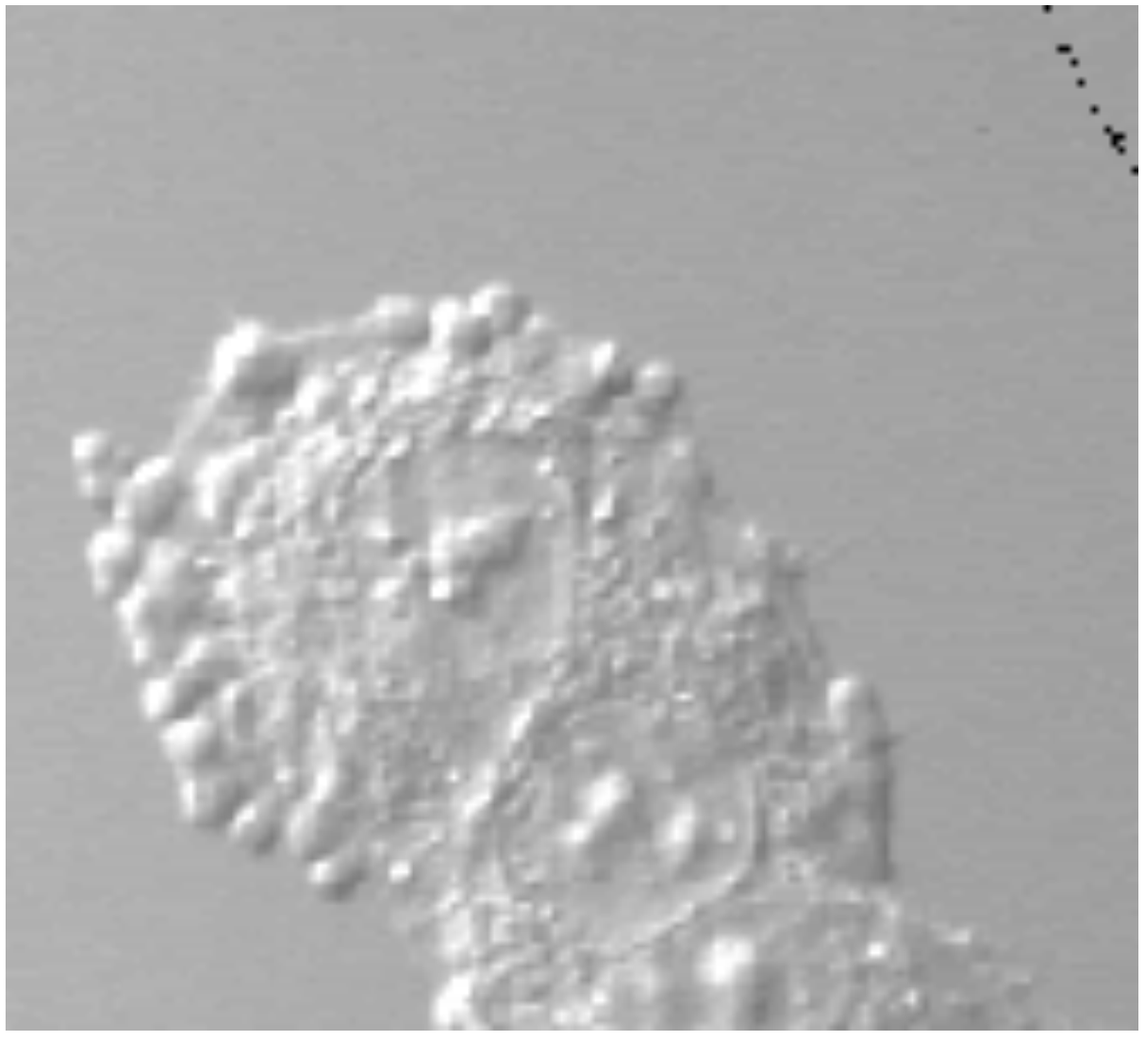
Vol 435|19 May 2005|doi:10.1038/nature03550

Cortical actin assembly



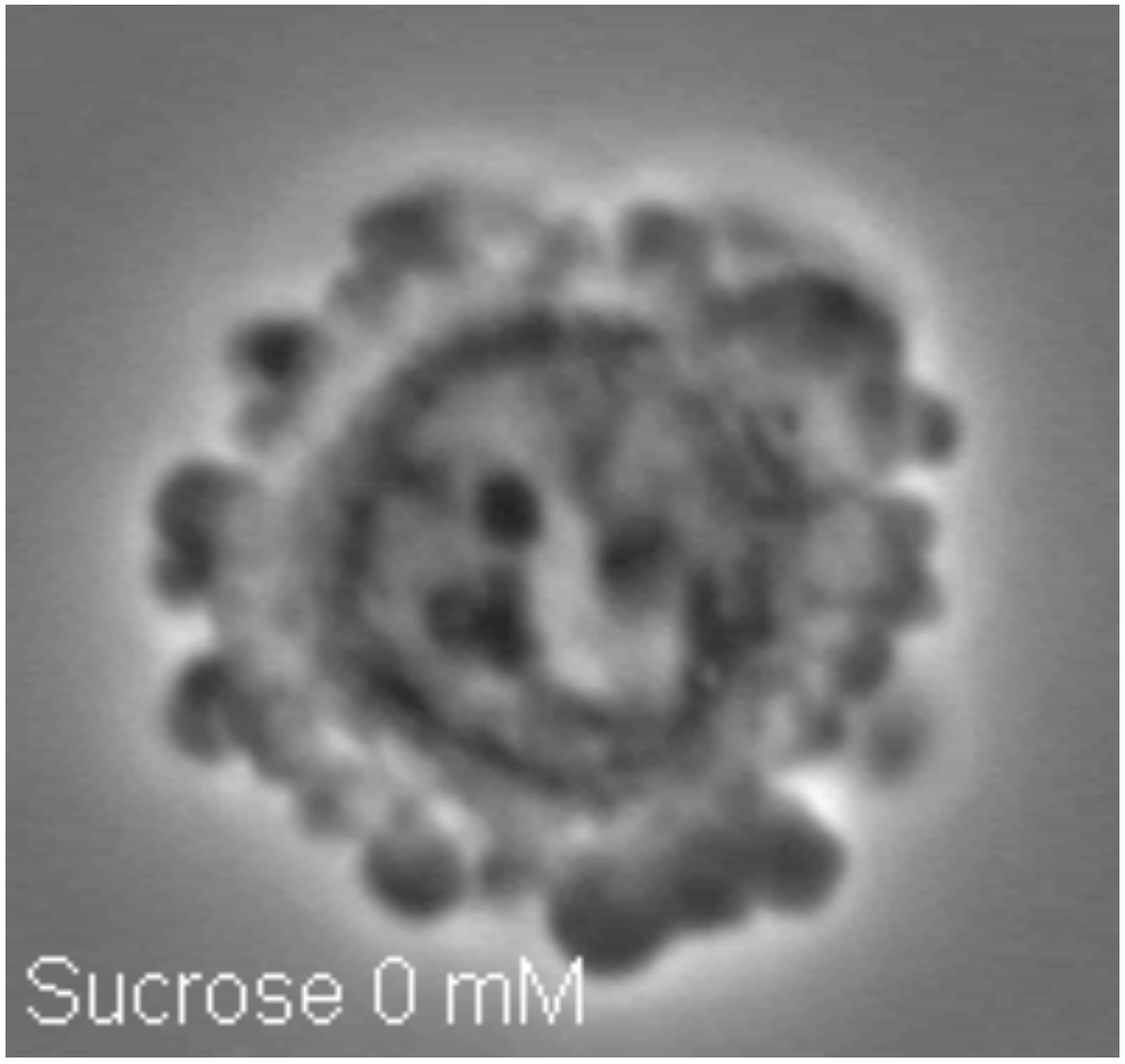
Cortical myosin assembly

Microplast (cell fragment) volume remains constant during blebbing



We first confirmed that the cell volume stays approximately constant during blebbing (Supplementary Data, Supplementary Video 12 and Supplementary Fig. 4)[18], implying that blebbing is driven primarily by flow of fluid within the cell rather than water crossing the plasma membrane. We then confirmed that bleb

Increasing extracellular osmolarity makes blebs smaller



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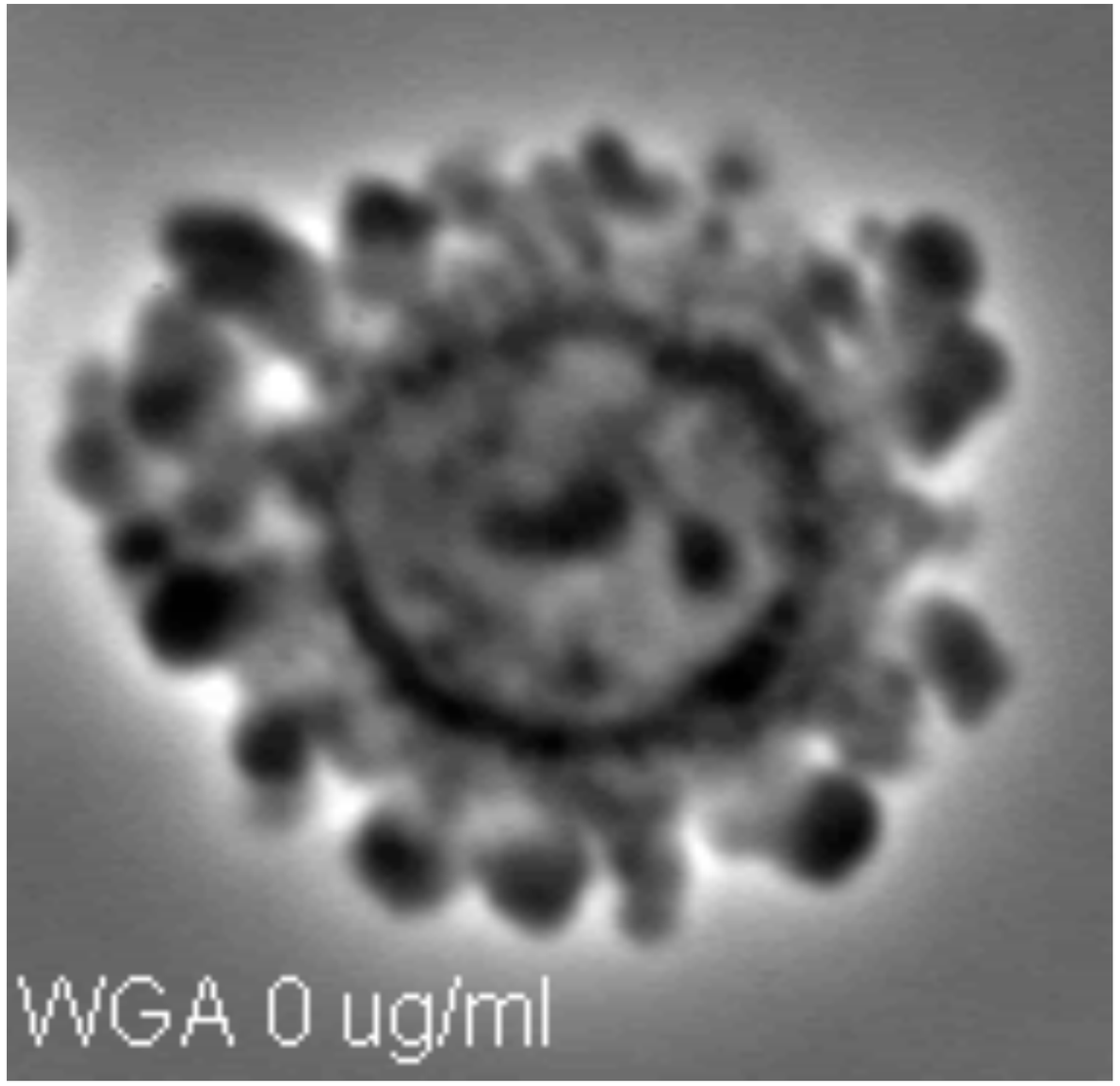
Source: Charras, Guillaume T. et al. "Non-equilibration of hydrostatic pressure in blebbing cells." Nature 435, no. 7040 (2005): 365-369.

contraction. Increasing extracellular osmolarity made blebs smaller, whereas decreasing it made them larger[22] (Fig. 1; see also Supplementary Video 1). Increasing membrane rigidity by crosslinking the

Increasing membrane rigidity inhibits blebbing



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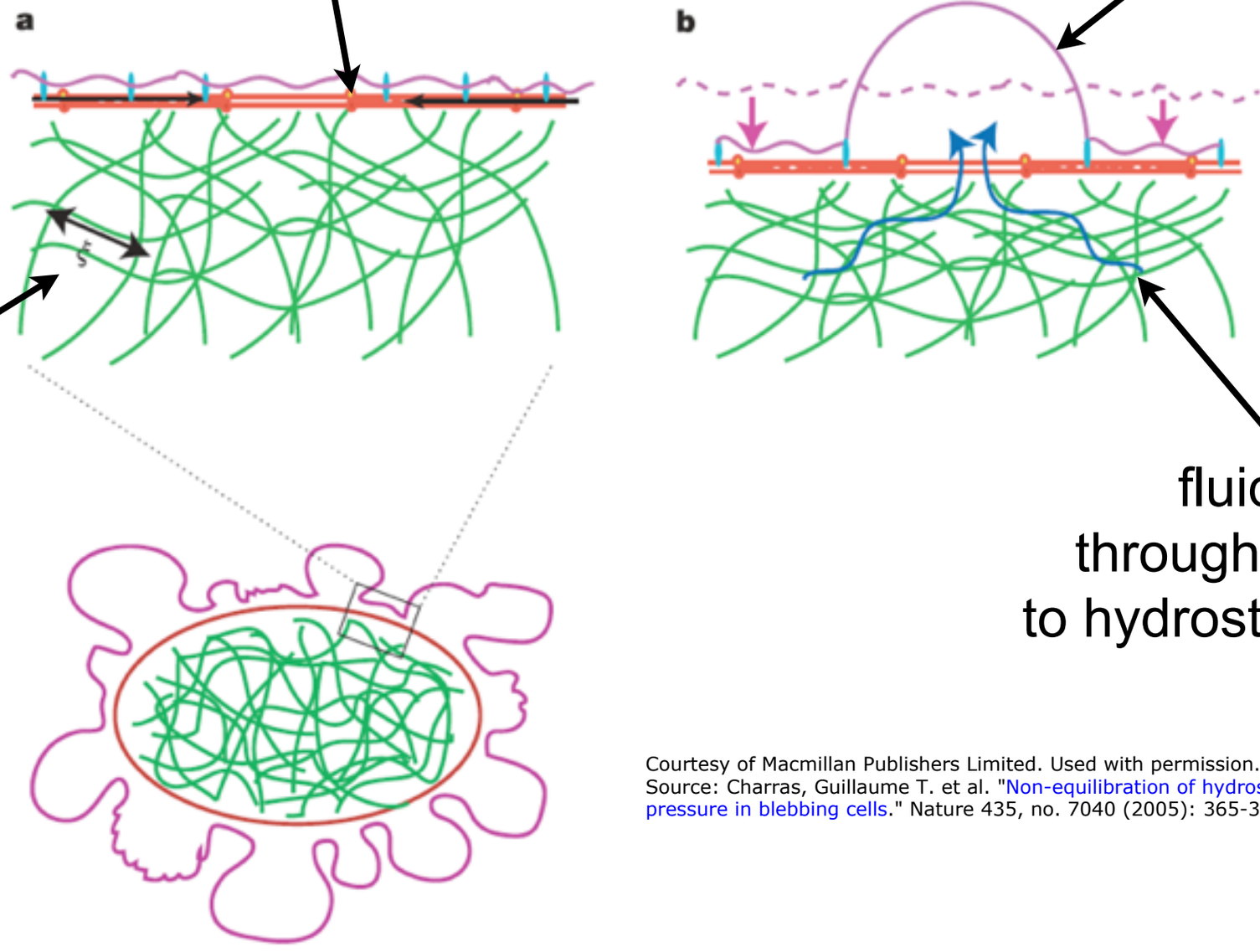
Source: Charras, Guillaume T. et al. "Non-equilibration of hydrostatic pressure in blebbing cells." Nature 435, no. 7040 (2005): 365-369.

tary Video 1). Increasing membrane rigidity by crosslinking the glycocalix polysaccharides with wheat germ agglutinin (WGA)[23] inhibits blebbing (Supplementary Video 2). These observations,

cortical acto-myosin contraction

bleb forms (rupture event)



pore-size or
mesh-size

fluid flows
through pores due
to hydrostatic pressure

together with drug studies discussed below, support the following qualitative model for bleb dynamics[19]. Cortical acto-myosin contracts (Supplementary Videos 10 and 11), generating hydrostatic pressure that causes a patch of plasma membrane to tear free from its attachment to the cortical cytoskeleton. This patch of cytoskeleton-free membrane rapidly inflates as cytosol flows in, with its base enlarging by further tearing (Supplementary Fig. 3). Later, inflation slows and a mesh of actin and myosin II assembles in the bleb to form a contractile cortex attached to the plasma membrane (Fig. 1b). Finally, contraction of this cortical mesh causes the bleb to shrink, driving the extruded cytosol back into the cell body.

Figures 7.14 and 7.15 removed due to copyright restrictions.
Source: Grodzinsky, Alan. Field, Forces and Flows in Biological Systems. Garland Science, 2011.

Fields, Forces, & Flows, Figures 7.14 & 7.15

20.430J / 2.795J / 6.561J / 10.539J Fields, Forces, and Flows in Biological Systems
Fall 2015