BE 159 Spring 2014
Final project

During BE 159, we have read contemporary research papers in depth and discussed them in class. Along with each discussion, I have provided you with the requisite background material through lecture. You have further explored the concepts through homework problems. It has been my hope that by digging deeply into a few papers, you have developed tools necessary to read more of the developmental biology literature, and even to perform research in the area.

For the final project, you will take a similar approach to a paper of your choice. You will choose a current research paper related to the topic we have covered in class. You will read the paper and any relevant background literature carefully so that you master the major concepts. Your discussion of your paper will be in two parts.

- You will present the paper you chose to the class, complete with the requisite background necessary to understand its main premises. You should target your talk to be 15 minutes long, plus five additional minutes for questions. This talk format is common in major conferences, for example in the annual meeting of the American Society of Cell Biology (ASCB). You can do a chalk talk, but this is very difficult to pull off, especially in 15 minutes, so I encourage you to use slides for your talk.
- You will write a "News and Views" piece about the paper. An article in the News and Views section of the journal *Nature* typically describes a current research paper to a non-expert audience. The articles are about two pages in length (this is two pages in magazine-style font, so yours will probably be about three pages) and usually have about 8 references. They provide a basic contextual background for paper, describe its major findings, and pose open questions in the field. Check out *Nature*'s website for examples of recent News and Views articles. A good example is this News and Views article that describes this paper on developmental biology.

There is a vast literature about signal transduction and morphogenesis. You are free to pick any paper of interest from the current literature. I have provided two sets of papers in the following pages. First is a list of research papers I think are interesting. Any paper from this list is appropriate to choose for your final project. I have a second set of papers which are review papers. These are very useful for introducing topics and pointing you to pertinent papers in the field. Do not choose a review paper for your final project (you must choose a research paper), but you can use these to help select a paper.

Please ok your paper with me ahead of time so we do not have duplicates. The presentations will take place during class on May 27, May 29, June 3, and June 5. Your News and Views write up is due by 5pm on June 6, along with homework 4.

Research articles

[1] B. Aigouy, R. Farhadifar, D. B. Staple, A. Sagner, J.-C. Röper, F. Jülicher, and S. Eaton. Cell Flow Reorients the Axis of Planar Polarity in the Wing Epithelium of Drosophila. *Cell*, 142(5):773–786, Mar. 2010. URL: http://dx.doi.org/10.1016/j.cell.2010.07.042, doi:10.1016/j.cell.2010.07.042.

[2] T. E. Angelini, E. Hannezo, X. Trepat, M. Marquez, J. J. Fredber, and D. A. Weitz. Glass-like dynamics of collective cell migration. *Proceedings of the National Academies of Sciences of the United States of America*, 108(12):4714–4719, Mar. 2011. URL: http://www.pnas.org/content/108/12/4714.full.pdf+html?with-ds=yes, doi:10.1073/pnas.1010059108/-/DCSupplemental.

[3] S. Ares, L. G. Morelli, D. J. Jörg, A. C. Oates, and F. Jülicher. Collective Modes of Coupled Phase Oscillators with Delayed Coupling. *Physical Review Letters*, 108(20):204101, May 2012. URL: http://link.aps.org/doi/10.1103/PhysRevLett.108.204101, doi:10.1103/PhysRevLett.108.204101.

[4] L. Bajard, L. G. Morelli, S. Ares, J. Pecreaux, F. Jülicher, and A. C. Oates. Wnt-regulated dynamics of positional information in zebrafish somitogenesis. *Development*, 141(6):1381–1391, Mar. 2014. URL: http://dev.biologists.org/cgi/doi/10.1242/dev.093435, doi:10.1242/dev.093435.

[5] M. Behrndt, G. Salbreux, P. Campinho, R. Hauschild, F. Oswald, J. Roensch, S. W. Grill, and C. P. Heisenberg. Forces Driving Epithelial Spreading in Zebrafish Gastrulation. *Science*, 338(6104):257–260, Oct. 2012. URL: http://www.sciencemag.org/cgi/doi/10.1126/science.1224143, doi:10.1126/science.1224143.

[6] W. Bialek and S. Setayeshgar. Cooperativity, Sensitivity, and Noise in Biochemical Signaling. *Physical Review Letters*, 100(25):258101, June 2008. URL: http://link.aps.org/doi/10.1103/PhysRevLett.100.258101, doi:10.1103/PhysRevLett.100.258101.

[7] J. T. Blankenship, S. T. Backovic, J. S. P. Sanny, O. Weitz, and J. A. Zallen. Multicellular Rosette Formation Links Planar Cell Polarity to Tissue Morphogenesis. *Developmental Cell*, 11(4):459–470, Oct. 2006. URL: http://linkinghub.elsevier.com/retrieve/pii/S153458070600400X, doi:10.1016/j.devcel.2006.09.007.

[8] C. P. Brangwynne, C. R. Eckmann, D. S. Courson, A. Rybarska, C. Hoege, J. Gharakhani, F. Juelicher, and A. A. Hyman. Germline P Granules Are Liquid Droplets That Localize by Controlled Dissolution/Condensation. *Science*, 324(5935):1729–1732, 2009. URL: http://www.sciencemag.org/cgi/content/abstract/324/5935/1729, doi:10.1126/science.1172046.

[9] A. Buxboim, K. Rajagopal, A. E. X. Brown, and D. E. Discher. How deeply cells feel: methods for thin gels. *Journal Of Physics-Condensed Matter*, 22(19):194116, 2010. URL: http://iopscience.iop.org/0953-8984/22/19/194116/, doi:10.1088/0953-8984/22/19/194116.

[10] Y. Cai, O. Rossier, N. C. Gauthier, N. Biais, M. A. Fardin, X. Zhang, L. W. Miller, B. Ladoux, V. W. Cornish, and M. P. Sheetz. Cytoskeletal coherence requires myosin-IIA contractility. *Journal Of Cell Science*, 123(3):413–423, Feb. 2010. URL: http://jcs.biologists.org/cgi/doi/10.1242/jcs.058297, doi:10.1242/jcs.058297.

[11] K. K. Chiou, L. Hufnagel, and B. I. Shraiman. Mechanical Stress Inference for Two Dimensional Cell Arrays. *Plos Computational Biology*, 8(5):e1002512, 2012. URL: http://dx.plos.org/10.1371/journal.pcbi.1002512.g001, doi:10.1371/journal.pcbi.1002512.g001.

[12] A. Diz-Munoz, M. Krieg, M. Bergert, I. Ibarlucea-Benitez, D. J. Muller, E. Paluch, and C.-P. Heisenberg. Control of Directed Cell Migration In Vivo by Membrane-to-Cortex Attachment. *PLoS Biology*, 8(11):e1000544, Nov. 2010. URL: http://dx.plos.org/10.1371/journal.pbio.1000544.s018, doi:10.1371/journal.pbio.1000544.s018.

[13] A. J. Engler, S. Sen, H. L. Sweeney, and D. E. Discher. Matrix Elasticity Directs Stem Cell Lineage Specification. *Cell*, 126(4):677–689, Aug. 2006. URL: http://linkinghub.elsevier.com/retrieve/pii/S0092867406009615, doi:10.1016/j.cell.2006.06.044.

[14] R. Farhadifar, J.-C. Roeper, B. Algouy, S. Eaton, and F. Juelicher. The influence of cell mechanics, cell-cell interactions, and proliferation on epithelial packing. *Current Biology*, 17(24):2095–2104, 2007. URL: http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VRT-4RBM5BB-3&_user=655616&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000035458&_version=1&_urlVersion=0&_userid=655616&md5=57ae7dde9fc66a9ad2172e42a1e4ab09, doi:10.1016/j.cub.2007.11.049.

[15] R. Fernandez-Gonzalez, S. de Matos Simoes, J.-C. Röper, S. Eaton, and J. A. Zallen. Short Article. *Developmental Cell*, 17(5):736–743, Nov. 2009. URL: http://dx.doi.org/10.1016/j.devcel.2009.09.003, doi:10.1016/j.devcel.2009.09.003.

[16] G. Forgacs, R. A. Foty, Y. Shafrir, and M. S. Steinberg. Viscoelastic Properties of Living Embryonic Tissues: a Quantitative Study. *Biophysj*, 74(5):2227–2234, May 1998. URL: http://dx.doi.org/10.1016/S0006-3495(98)77932-9, doi:10.1016/S0006-3495(98)77932-9.

[17] M. A. Gelbart, B. He, A. C. Martin, S. Y. Thiberge, E. F. Wieschaus, and M. Kaschube. Volume conservation principle involved in celllengthening and nucleus movement during tissue morphogenesis. *Proceedings of the National Academies of Sciences of the United States of America*, 109:19298–19303, Nov. 2012. URL: http://www.pnas.org.clsproxy.library.caltech.edu/content/109/47/19298.full.pdf+html?with-ds=yes, doi:10.1073/pnas.1205258109/-/DCSupplemental.

[18] T. Gregor, D. W. Tank, E. F. Wieschaus, and W. Bialek. Probing the limits to positional information. *Cell*, 130(1):153–164, 2007. URL: http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6WSN-4P5S9V1-M&_user=1010281&_coverDate=07%2F13%2F2007&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_acct=C000050264&_version=1&_urlVersion=0&_userid=1010281&md5=72555a4a68ecf69b5cfc4a4c19f6d6a6&searchtype=a, doi:10.1016/j.cell.2007.05.025.

[19] C.-L. Guo, M. Ouyang, J.-Y. Yu, J. Maslov, A. Price, and C.-Y. Shen. Long-range mechanical force enables self-assembly of epithelial tubular patterns. *Proceedings of the National Academies of Sciences of the Unites States of America*, 109(15):5576–5582, Nov. 2012. URL: http://www.pnas.org/content/109/15/5576.full.pdf+html?with-ds=yes, doi:10.1073/pnas.1114781109/-/DCSupplemental/pnas.1114781109_SI.pdf.

[20] S. L. Haigo and D. Bilder. Global Tissue Revolutions in a Morphogenetic Movement Controlling Elongation. *Science*, 331(6020):1071–1074, Feb. 2011. URL: http://www.sciencemag.org/cgi/doi/10.1126/science.1199424, doi:10.1126/science.1199424.

[21] B. He, K. Doubrovinski, O. Polyakov, and E. Wieschaus. Apical constriction drives tissue-scale hydrodynamic flow to mediate cell elongation. *Nature*, pages 1–17, Mar. 2014. URL: http://dx.doi.org/10.1038/nature13070, doi:10.1038/nature13070.

[22] L. He, X. Wang, H. L. Tang, and D. J. Montell. Tissue elongation requires oscillating contractions of a basal actomyosin network. *Nature Cell Biology*, 12(12):1133–1142, Nov. 2010. URL: http://dx.doi.org/10.1038/ncb2124, doi:10.1038/ncb2124.

[23] L. Hufnagel, A. A. Teleman, H. Rouault, S. M. Cohen, and B. I. Shraiman. On the mechanism of wing size determination in fly development. *Proceedings Of The National Academy Of Sciences Of The United States Of America*, 104(10):3835–3840, 2007. URL: http://www.pnas.org/content/104/10/3835.short, doi:10.1073/pnas.0607134104.

[24] A. Kicheva, P. Pantazis, T. Bollenbach, Y. Kalaidzidis, T. Bittig, F. Jülicher, and M. Gonzalez-Gaitan. Kinetics of Morphogen Gradient Formation. *Science*, 315(5811):521–525, Jan. 2007. doi:10.1126/science.1135774.

[25] K. S. Kolahi, P. F. White, D. M. Shreter, A. K. Classen, D. Bilder, and M. R. K. Mofrad. Quantitative analysis of epithelial morphogenesis in Drosophila oogenesis: New insights based on morphometric analysis and mechanical modeling. *Developmental Biology*, 331(2):129–139, July 2009. URL: http://dx.doi.org/10.1016/j.ydbio.2009.04.028, doi:10.1016/j.ydbio.2009.04.028.

[26] M. Krieg, Y. Arboleda-Estudillo, P. H. Puech, J. Käfer, F. Graner, D. J. Müller, and C. P. Heisenberg. Tensile forces govern germ-layer organization in zebrafish. *Nature Cell Biology*, 10(4):429–436, Mar. 2008. URL: http://www.nature.com/doifinder/10.1038/ncb1705, doi:10.1038/ncb1705.

[27] R. Krishnan, D. D. Klumpers, C. Y. Park, K. Rajendran, X. Trepat, J. van Bezu, V. W. M. van Hinsbergh, C. V. Carman, J. D. Brain, J. J. Fredberg, J. P. Butler, and G. P. van Nieuw Amerongen. Substrate stiffening promotes endothelial monolayer disruption through enhanced physical forces. *AJP: Cell Physiology*, 300(1):C146–C154, Dec. 2010. URL: http://ajpcell.physiology.org/cgi/doi/10.1152/ajpcell.00195.2010, doi:10.1152/ajpcell.00195.2010.

[28] R. Levayer, A. Pelissier-Monier, and T. Lecuit. Spatial regulation of Dia and Myosin-II by RhoGEF2 controls initiation of E-cadherin endocytosis during epithelial morphogenesis . *Nature Cell Biology*, 13(5):529–540, Apr. 2011. URL: http://dx.doi.org/10.1038/ncb2224, doi:10.1038/ncb2224.

[29] K. R. Levental, H. Yu, L. Kass, J. N. Lakins, M. Egeblad, J. T. Erler, S. F. T. Fong, K. Csiszar, A. Giaccia, W. Weninger, M. Yamauchi, D. L. Gasser, and V. M. Weaver. Matrix Crosslinking Forces Tumor Progression by Enhancing Integrin Signaling. *Cell*, 139(5):891–906, Nov. 2009. URL: http://dx.doi.org/10.1016/j.cell.2009.10.027, doi:10.1016/j.cell.2009.10.027.

[30] Y.-C. Lin, D. T. Tambe, C. Y. Park, M. R. Wasserman, X. Trepat, R. Krishnan, G. Lenormand, J. J. Fredberg, and J. P. Butler. Mechanosensing of substrate thickness. *Physical Review E*, 82(4):041918, Oct. 2010. URL: http://link.aps.org/doi/10.1103/PhysRevE.82.041918, doi:10.1103/PhysRevE.82.041918.

[31] J. I. Lopez, I. Kang, W.-K. You, D. M. McDonald, and V. M. Weaver. In situ force mapping of mammary gland transformation. *Integrative Biology*, 3(9):910, 2011. URL: http://xlink.rsc.org/?DOI=c1ib00043h, doi:10.1039/c1ib00043h.

[32] W. Luo, C. h. Yu, Z. Z. Lieu, J. Allard, A. Mogilner, M. P. Sheetz, and A. D. Bershadsky. Analysis of the local organization and dynamics of cellular actin networks. *The Journal of cell biology*, 202(7):1057–1073, Sept. 2013. URL: http://jcb-dataviewer.rupress.org/jcb/doi/10.1083/jcb.201210123, doi:10.1083/jcb.201210123.dv.

[33] A. C. Martin, M. Gelbart, R. Fernandez-Gonzalez, M. Kaschube, and E. F. Wieschaus. Integration of contractile forces during tissue invagination. *The Journal of cell biology*, 188(5):735–749, Mar. 2010. URL: http://www.jcb.org/cgi/doi/10.1083/jcb.200910099, doi:10.1083/jcb.200910099.

[34] K. Pataky, T. Braschler, A. Negro, P. Renaud, M. P. Lutolf, and J. Brugger. Microdrop Printing of Hydrogel Bioinks into 3D Tissue-Like Geometries. *Advanced Materials*, 24(3):391–396, Dec. 2011. URL: http://doi.wiley.com/10.1002/adma.201102800, doi:10.1002/adma.201102800.

[35] S. Y. Qi, J. T. Groves, and A. K. Chakraborty. Synaptic pattern formation during cellular recognition. *Proceedings of the National Academies of Sciences of the United States of America*, 98(12):6548–6553, May 2001. URL: http://www.pnas.org.clsproxy.library.caltech.edu/content/98/12/6548.full.pdf+html.

[36] B.-A. T. Quang, M. Mani, O. Markova, T. Lecuit, and P.-F. Lenne. Principles of E-Cadherin Supramolecular Organization In Vivo. *Current Biology*, 23(22):2197–2207, Nov. 2013. URL: http://dx.doi.org/10.1016/j.cub.2013.09.015, doi:10.1016/j.cub.2013.09.015.

[37] J. Ranft, M. Aliee, J. Prost, F. Jülicher, and J.-F. Joanny. Mechanically driven interface propagation in biological tissues. *New Journal Of Physics*, pages 1–11, Feb. 2014. URL: http://iopscience.iop.org/1367-2630/16/3/035002/pdf/1367-2630_16_3_035002.pdf, doi:10.1088/1367-2630/16/3/035002.

[38] J. Ranft, M. Basan, J. Elgeti, J.-F. Joanny, J. Prost, and F. Jülicher. Fluidization of tissues by cell division and apoptosis. *Proceedings of the National Academy of Sciences of the USA*, 107(49):20863–20868, Nov. 2010.

[39] M. Rauzi, P.-F. Lenne, and T. Lecuit. Planar polarized actomyosin contractile flows control epithelial junction remodelling. *Nature*, 468(7327):1110–U515, 2010. URL: http://www.nature.com/nature/journal/v468/n7327/full/nature09566.html, doi:10.1038/nature09566.

[40] K. Salaita, P. M. Nair, R. S. Petit, R. M. Neve, D. Das, J. W. Gray, and J. T. Groves. Restriction of Receptor Movement Alters Cellular Response: Physical Force Sensing by EphA2. *Science*, 327(5971):1380–1385, Mar. 2010. URL: http://www.sciencemag.org/cgi/doi/10.1126/science.1181729, doi:10.1126/science.1181729.

[41] G. Salbreux, J. Prost, and J. F. Joanny. Hydrodynamics of Cellular Cortical Flows and the Formation of Contractile Rings. *Physical Review Letters*, 103(5):1–4, July 2009. doi:10.1103/PhysRevLett.103.058102.

[42] M. S. Samuel, J. I. Lopez, E. J. McGhee, D. R. Croft, D. Strachan, P. Timpson, J. Munro, E. Schröder, J. Zhou, V. G. Brunton, N. Barker, H. Clevers, O. J. Sansom, K. I. Anderson, V. M. Weaver, and M. F. Olson. Actomyosin-Mediated Cellular Tension Drives Increased Tissue Stiffness and b-Catenin Activation to Induce Epidermal Hyperplasia and Tumor Growth. *Cancer Cell*, 19(6):776–791, June 2011. URL: http://dx.doi.org/10.1016/j.ccr.2011.05.008, doi:10.1016/j.ccr.2011.05.008.

[43] A. Sanger, M. Merkel, B. Aigouy, J. Gaebel, M. Brankatschk, F. Jülicher, and S. Eaton. Establishment of Global Patterns of Planar Polarity during Growth of the Drosophila Wing Epithelium. *Current Biology*, 22(14):1296–1301, July 2012. URL: http://dx.doi.org/10.1016/j.cub.2012.04.066, doi:10.1016/j.cub.2012.04.066.

[44] X. Serra-Picamal, V. Conte, R. Vincent, E. Anon, D. T. Tambe, E. Bazellieres, J. P. Butler, J. J. Fredberg, and X. Trepat. Mechanical waves during tissue expansion. *Nature Physics*, 8(8):628–634, July 2012. URL: http://dx.doi.org/10.1038/nphys2355, doi:10.1038/nphys2355.

[45] R. Sheth, L. Marcon, M. F. Bastida, M. Junco, L. Quintana, R. Dahn, M. Kmita, J. Sharpe, and M. A. Ros. Hox Genes Regulate Digit Patterning by Controlling the Wavelength of a Turing-Type Mechanism. *Science*, 338(6113):1476–1480, Dec. 2012. URL: http://www.sciencemag.org/cgi/doi/10.1126/science.1226804, doi:10.1126/science.1226804.

[46] D. S. A. Simakov, L. S. Cheung, L. M. Pismen, and S. Y. Shvartsman. EGFR-dependent network interactions that pattern Drosophila eggshell appendages. *Development*, 139(15):2814–2820, July 2012. URL: http://dev.biologists.org/cgi/doi/10.1242/dev.077669, doi:10.1242/dev.077669.

[47] K. M. Stroka, H. Jiang, S.-H. Chen, Z. Tong, D. Wirtz, S. X. Sun, and K. Konstantopoulos. Water Permeation Drives Tumor Cell Migration in Confined Microenvironments. *Cell*, pages 1–13, Apr. 2014. URL: http://dx.doi.org/10.1016/j.cell.2014.02.052, doi:10.1016/j.cell.2014.02.052.

[48] D. T. Tambe. Collective cell guidance by cooperativeintercellular forces. *Nature Materials*, 10(6):469–475, May 2011. URL: http://dx.doi.org/10.1038/nmat3025, doi:10.1038/nmat3025.

[49] Y.-C. Wang, Z. Khan, M. Kaschube, and E. F. Wieschaus. Differential positioning of adherens junctions is associated with initiation of epithelial folding. *Nature*, 484(7394):390–393, Mar. 2012. URL: http://www.nature.com/doifinder/10.1038/nature10938, doi:10.1038/nature10938.

[50] G. F. Weber, M. A. Bjerke, and D. W. DeSimone. A Mechanoresponsive Cadherin-Keratin Complex Directs Polarized Protrusive Behavior and Collective Cell Migration. *Developmental Cell*, 22(1):104–115, Jan. 2012. URL: http://dx.doi.org/10.1016/j.devcel.2011.10.013, doi:10.1016/j.devcel.2011.10.013.

[51] M. Weber, R. Hauschild, J. Schwarz, C. Moussion, I. de Vries, D. F. Legler, S. A. Luther, T. Bollenbach, and M. Sixt. Interstitial Dendritic Cell Guidance by Haptotactic Chemokine Gradients. *Science*, 339(6117):328–332, Jan. 2013. URL: http://www.sciencemag.org/cgi/doi/10.1126/science.1228456, doi:10.1126/science.1228456.

[52] T. Yeung, P. C. Georges, L. A. Flanagan, B. Marg, M. Ortiz, M. Funaki, N. Zahir, W. Ming, V. Weaver, and P. A. Janmey. Effects of substrate stiffness on cell morphology, cytoskeletal structure, and adhesion. *Cell Motility And The Cytoskeleton*, 60(1):24–34, 2004. URL: http://doi.wiley.com/10.1002/cm.20041, doi:10.1002/cm.20041.

[53] J. J. Zartman, J. S. Kanodia, N. Yakoby, X. Schafer, C. Watson, K. Schlichting, C. Dahmann, and S. Y. Shvartsman. Expression patterns of cadherin genes in Drosophila oogenesis. *Gene Expression Patterns*, 9(1):31–36, 2009. URL: http://www.sciencedirect.com/science/article/pii/S1567133X08001075, doi:10.1016/j.gep.2008.09.001.

[54] R. Zerzour, J. Kroeger, and A. Geitmann. Polar growth in pollen tubes is associated with spatially confined dynamic changes in cell mechanical properties. *Developmental Biology*, 334(2):437–446, Oct. 2009. URL: http://dx.doi.org/10.1016/j.ydbio.2009.07.044, doi:10.1016/j.ydbio.2009.07.044.

Review articles

[55] V. Barone and C.-P. Heisenberg. Cell adhesion in embryo morphogenesis. *Current Opinion In Cell Biology*, 24(1):148–153, Feb. 2012. URL: http://dx.doi.org/10.1016/j.ceb.2011.11.006, doi:10.1016/j.ceb.2011.11.006.

[56] D. Bilder and S. L. Haigo. Expanding the Morphogenetic Repertoire: Perspectives from the *Drosophila* Egg. *Developmental Cell*, 22(1):12–23, Jan. 2012. URL: http://dx.doi.org/10.1016/j.devcel.2011.12.003, doi:10.1016/j.devcel.2011.12.003.

[57] D. T. Butcher, T. Alliston, and V. M. Weaver. A tense situation: forcing tumour progression. *Nature Reviews Cancer*, 9(2):108–122, Feb. 2009. URL: http://www.nature.com/doifinder/10.1038/nrc2544, doi:10.1038/nrc2544.

[58] A. Buxboim, I. L. Ivanovska, and D. E. Discher. Matrix elasticity, cytoskeletal forces and physics of the nucleus: how deeply do cells 'feel' outside and in? *Journal Of Cell Science*, 123(3):297–308, 2010. URL: http://jcs.biologists.org/cgi/content/abstract/123/3/297, doi:10.1242/jcs.041186.

[59] C. C. DuFort, M. J. Paszek, and V. M. Weaver. Balancing forces: architectural control of mechanotransduction. *Nature Reviews Molecular Cell Biology*, 12(5):308–319, May 2011. URL: http://dx.doi.org/10.1038/nrm3112, doi:10.1038/nrm3112.

[60] A. J. Engler, P. O. Humbert, B. Wehrle-Haller, and V. M. Weaver. Multiscale Modeling of Form and Function. *Science*, 324:208–212, Apr. 2009. URL: http://www.sciencemag.org.clsproxy.library.caltech.edu/content/324/5924/208.full.pdf?sid=2a7cd7f7-aa4f-41c2-b298-f0fb8b2b3cd9.

[61] Y. E. K. F and M. P. Sheetz. Force-dependent cell signaling in stem cell differentiation. *Stem Cell Research and Therapy*, 3:41, Oct. 2012. URL: http://www.ncbi.nlm.nih.gov.clsproxy.library.caltech.edu/pmc/articles/PMC3580432/pdf/scrt132.pdf.

[62] A. Geitmann and J. K. E. Ortega. Mechanics and modeling of plant cell growth. *Trends in Plant Science*, 14(9):467–478, Sept. 2009. doi:10.1016/j.tplants.2009.07.006.

[63] C. Guillot and T. Lecuit. Mechanics of Epithelial Tissue Homeostasis and Morphogenesis. *Science*, 340(6137):1185–1189, June 2013. URL: http://www.sciencemag.org/cgi/doi/10.1126/science.1235249, doi:10.1126/science.1235249.

[64] C.-P. Heisenberg and Y. Bellaïche. Forces in Tissue Morphogenesis and Patterning. *Cell*, 153(5):948–962, May 2013. URL: http://dx.doi.org/10.1016/j.cell.2013.05.008, doi:10.1016/j.cell.2013.05.008.

[65] D. S. Johnston and B. Sanson. Epithelial polarity and morphogenesis. *Current Opinion In Cell Biology*, 23(5):540–546, Oct. 2011. URL: http://dx.doi.org/10.1016/j.ceb.2011.07.005, doi:10.1016/j.ceb.2011.07.005.

[66] K. E. Kasza and J. A. Zallen. Dynamics and regulation of contractile actin-myosin networks in morphogenesis. *Current Opinion In Cell Biology*, 23(1):30–38, Feb. 2011. URL: http://dx.doi.org/10.1016/j.ceb.2010.10.014, doi:10.1016/j.ceb.2010.10.014.

[67] P. Kollmannsberger, C. M. Bidan, J. W. C. Dunlop, and P. Fratzl. The physics of tissue patterning and extracellular matrix organisation: how cells join forces. *Soft Matter*, 7(20):9549, 2011. URL: http://xlink.rsc.org/?DOI=c1sm05588g, doi:10.1039/c1sm05588g.

[68] A. D. Lander. How Cells Know Where They Are. *Science*, 339(6122):923–927, Feb. 2013. URL: http://www.sciencemag.org/cgi/doi/10.1126/science.1224186, doi:10.1126/science.1224186.

[69] J. Lewis. From Signals to Patterns: Space, Time, and Mathematics in Developmental Biology. *Science*, 322(5900):399–403, Oct. 2008. URL: http://www.sciencemag.org/cgi/doi/10.1126/science.1166022, doi:10.1126/science.1166022.

[70] P. Lu, V. M. Weaver, and Z. Werb. The extracellular matrix: A dynamic niche in cancer progression. *The Journal of cell biology*, 196(4):395–406, Feb. 2012. URL: http://www.jcb.org/cgi/doi/10.1083/jcb.201102147, doi:10.1084/jem.186.12.1985.

[71] T. Mammoto and D. E. Ingber. Mechanical control of tissue and organ development. *Development*, 137(9):1407–1420, 2010. URL: http://dev.biologists.org/content/137/9/1407, doi:10.1242/dev.024166.

[72] A. Mogilner, J. Allard, and R. Wollman. Cell Polarity: Quantitative Modeling as a Tool in Cell Biology. *Science*, 336(6078):175–179, Apr. 2012. URL: http://www.sciencemag.org/cgi/doi/10.1126/science.1216380, doi:10.1126/science.1216380.

[73] D. J. Montell. Morphogenetic Cell Movements: Diversity from Modular Mechanical Properties. *Science*, 322:1502–1505, Dec. 2008. URL: http://www.sciencemag.org.clsproxy.library.caltech.edu/content/322/5907/1502.full.pdf?sid=14381d79-cf21-457e-9dbd-ff8d6673e15d.

[74] S. W. Moore, P. Roca-Cusachs, and M. P. Sheetz. Stretchy Proteins on Stretchy Substrates: The Important Elements of Integrin-Mediated Rigidity Sensing. *Developmental Cell*, 19(2):194–206, Aug. 2010. URL: http://dx.doi.org/10.1016/j.devcel.2010.07.018, doi:10.1016/j.devcel.2010.07.018.

[75] L. G. Morelli, K. Uriu, S. Ares, and A. C. Oates. Computational Approaches to Developmental Patterning. *Science*, 336(6078):187–191, Apr. 2012. URL: http://www.sciencemag.org/cgi/doi/10.1126/science.1215478, doi:10.1126/science.1215478.

[76] J. Nance and J. A. Zallen. Elaborating polarity: PAR proteins and the cytoskeleton. *Development*, 138(5):799–809, Feb. 2011. URL: http://dev.biologists.org/cgi/doi/10.1242/dev.053538, doi:10.1242/dev.053538.

[77] A. C. Oates, L. G. Morelli, and S. Ares. Patterning embryos with oscillations: structure, function and dynamics of the vertebrate segmentation clock. *Development*, 139(4):625–639, Jan. 2012. URL: http://dev.biologists.org/cgi/doi/10.1242/dev.063735, doi:10.1242/dev.063735.

[78] E. Paluch and C.-P. Heisenberg. Biology and Physics of Cell Shape Changes Review in Development. *Current Biology*, 19(17):R790–R799, Sept. 2009. URL: http://dx.doi.org/10.1016/j.cub.2009.07.029, doi:10.1016/j.cub.2009.07.029.

[79] E. Puklin-Faucher and M. P. Sheetz. The mechanical integrin cycle. *Journal Of Cell Science*, 122(2):179–186, 2009. URL: http://jcs.biologists.org/cgi/content/abstract/122/2/179, doi:10.1242/jcs.042127.

[80] J. Renkawitz and M. Sixt. Mechanisms of force generation and force transmission during interstitial leukocyte migration. *Nature Publishing Group*, 11(10):744–750, Sept. 2010. URL: http://embor.embopress.org/cgi/doi/10.1038/embor.2010.147, doi:10.1038/embor.2010.147.

[81] M. P. Sheetz, J. E. Sable, and H.-G. Döbereiner. Continuous Membrane-Cytoskeleton Adhesion Requires Continuous Accommodation to Lipid and Cytoskeleton Dynamics. *Annu Rev Bioph Biom Struct*, 35:417–434, Mar. 2006. URL: http://www.annualreviews.org.clsproxy.library.caltech.edu/doi/pdf/10.1146/annurev.biophys.35.040405.102017.

[82] D. Stamenovic and D. E. Ingber. Tensegrity-guided self assembly: from molecules to living cells. *Soft Matter*, 5(6):1137–1145, 2009. URL: http://www.rsc.org/publishing/journals/SM/article.asp?doi=b806442c, doi:10.1039/b806442c.

[83] A. Stathopoulos and D. Iber. Studies of morphogens: keep calm and carry on. *Development*, 140(20):4119–4124, Oct. 2013. URL: http://dev.biologists.org/cgi/doi/10.1242/dev.095141, doi:10.1242/dev.095141.

[84] A. Vichas and J. A. Zallen. Translating cell polarity into tissue elongation. *Seminars In Cell & Developmental Biology*, 22(8):858–864, Oct. 2011. URL: http://dx.doi.org/10.1016/j.semcdb.2011.09.013, doi:10.1016/j.semcdb.2011.09.013.

[85] V. Vogel and M. P. Sheetz. Cell fate regulation by coupling mechanical cycles to biochemical signaling pathways. *Current Opinion In Cell Biology*, 21(1):38–46, Feb. 2009. URL: http://linkinghub.elsevier.com/retrieve/pii/S0955067409000040, doi:10.1016/j.ceb.2009.01.002.