Stanford

Miriam B. Goodman

Mrs. George A. Winzer Professor of Cell Biology

Molecular and Cellular Physiology

CONTACT INFORMATION

- **Administrative Contact**

  Sara Johnson - Administrative Associate

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Bio

ACADEMIC APPOINTMENTS

- Professor, Molecular and Cellular Physiology
- Member, Bio-X
- Member, Stanford Cancer Institute
- Member, Wu Tsai Neurosciences Institute

ADMINISTRATIVE APPOINTMENTS

- Chair, Molecular and Cellular Physiology, (2017- present)
- Associate Chair, Molecular and Cellular Physiology, (2010-2013)
- Chair, Stanford Neuroscience Institute (SNI) Interdisciplinary Scholars Program, (2014- present)
- Deputy Director, Stanford Neuroscience Institute, (2013-2017)

HONORS AND AWARDS

- Distinguished Alumni Award, The University of Chicago (May 2024)
- Landis Award for Outstanding Mentoring, National Institutes of Neurological Disorders and Stroke, NIH (2019)
- Excellence in Diversity and Inclusion, Stanford University School of Medicine (2015)
- Excellence in Graduate Teaching, Stanford University School of Medicine (2011, 2014)
- MIchael and Kate Barany Award for Young Investiators, Biophysical Society (2014)
- Klingenstein Fellow in Neuroscience, The Klingenstein Fund (2005-2008)
- McKnight Scholar Award, McKnight Endowment (2005-2008)
- Prize in Neurobiology, Eppendorf & Science (2004)
- Alfred P. Sloan Fellow, Alfred P. Sloan Foundation (2002-2004)
- Baxter Fellow, Donald B. and Delia E. Baxter Foundation (2002)
- Terman Fellow, Stanford University (2002)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Member, Advisory Board, San Jose State University Research Foundation (2024 - present)
- Reviewing Editor, eNeuro (2017 - 2023)
- Editorial Board Member, Institute of Physics/Biophysical Society eBooks (2016 - 2020)
- Editorial Board Member, Section on Ion Channels & Transporters, Biophysical Journal (2013 - 2018)
- Editorial Advisory Board, Journal of General Physiology (2011 - 2018)
- Academic Editor, PloS Genetics (2009 - 2013)

PROFESSIONAL EDUCATION

- Ph.D., The University of Chicago , Neurobiology (1995)
- Sc.B., Brown University , Biochemistry (1986)

LINKS

- Goodman Lab Site: http://med.stanford.edu/goodmanlab.html

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

We study the molecular events that give rise to the sensation of touch and temperature using C. elegans nematodes as a model system. To do this, we use a combination of quantitative behavioral analysis, genetics, in vivo electrophysiology, CRISPR-mediated gene editiing, light and electron microscopy, and heterologous expression of ion channels. Additionally, we seek to better understand how sensory neurons withstand mechanical and chemical stresses, including chemotherapy drugs and elevated levels of glucose characeristic of diabetes.

Teaching

COURSES

2025-26

- Designing Your Life: Empowering Emerging Scientists: BIOS 302 (Aut)
- Neuro-Cellular Core: NEPR 201 (Aut)

2024-25

- Cellular/Molecular Neuroscience Laboratory: NEPR 288 (Aut)

2023-24

- DataLucence::Images: BIOS 254 (Aut)
- Diversity and Inclusion in STEMM: BIOS 225 (Spr)

2022-23

- Designing Your Life: Empowering Emerging Scientists: BIOS 302 (Win)
- Diversity and Inclusion in STEMM: BIOS 225 (Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Suzanna Bennett, Shawn Dhillon, Liz Lopez, Ilana Zucker-Scharff

Postdoctoral Faculty Sponsor

Hongfei Ji, Lucero Rogel, Manuel Ruiz

Doctoral Dissertation Advisor (AC)

Wagner Nors, Lexy Strom

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biophysics (Phd Program)
- Molecular and Cellular Physiology (Phd Program)
- Neurosciences (Phd Program)

Publications

PUBLICATIONS

- **Mechanosensitive Polymer Matrices of Biologically-Relevant Compliance Based on Upconverting Nanoparticles.** *Advanced materials (Deerfield Beach, Fla.)*
  Shi, C. H., Cano, M. C., Casar, J. R., Moradifar, P., Robinson, B. G., Kaltschmidt, J. A., Goodman, M. B., Dionne, J. A.
  2026: e22706
- **The extracellular matrix gene mec-9 regulates C. elegans sensory cilia.** *bioRxiv : the preprint server for biology*
  Jacobs, K. C., De Vore, D. M., Knobel, K. M., Walsh, J. D., Das, A., Dobossy, L. M., Nikonorova, I. A., Nguyen, K. C., Goodman, M. B., Hall, D. H., Barr, M. M.
  2026
- **The anticonvulsant and mood-stabilizing drug valproic acid attracts C. elegans and activates chemosensory neurons via a cGMP signaling pathway.** *bioRxiv : the preprint server for biology*
  Rogel-Hernandez, L. E., Casademunt, H., Samuel, A. D., Goodman, M. B.
  2025
- **Ten simple rules for maximizing summer research experiences for students, mentors, and research groups.** *PLoS computational biology*
  Goodman, M. B.
  2025; 21 (11): e1013731
- **Satiety, TAX-4, and OSM-9 Tune the Attraction of C. elegans Nematodes to Microbial Fermentation Products.** *G3 (Bethesda, Md.)*
  Logan-Garbisch, T., Fryer, E., Seyahi, L. S., Rogel-Hernandez, L., Rhee, S. Y., Goodman, M. B.
  2025
- **Upconverting microgauges reveal intraluminal force dynamics in vivo.** *ArXiv*
  Casar, J. R., McLellan, C. A., Shi, C., Stiber, A., Lay, A., Siefe, C., Parakh, A., Gaerlan, M., Gu, W., Goodman, M. B., Dionne, J. A.
  2025
- **Upconverting microgauges reveal intraluminal force dynamicsin vivo.** *ArXiv*
  Casar, J. R., McLellan, C. A., Shi, C., Stiber, A., Lay, A., Siefe, C., Parakh, A., Gaerlan, M., Gu, W., Goodman, M. B., Dionne, J. A.
  2025
- **Valeric acid attracts C. elegans by activating the AWC neurons through a tax-4 -dependent signaling pathway.** *microPublication biology*
  Sarkar, S., Rogel-Hernandez, L. E., Logan-Garbisch, T., Fryer, E., Johnson, V., Goodman, M. B.
  2025; 2025
- **Satiety, TAX-4, and OSM-9 Tune the Attraction of C. elegans Nematodes to Microbial Fermentation Products.** *bioRxiv : the preprint server for biology*
  Logan-Garbisch, T., Fryer, E., Seyahi, L. S., Rogel-Hernandez, L., Rhee, S. Y., Goodman, M. B.
  2025
- **Upconverting microgauges reveal intraluminal force dynamics in vivo**
  Casar, J. R., Goodman, M. B., Dionne, J. A., Mclellan, C. A., Shi, C., Gaerlan, M., Stiber, A.
  CELL PRESS.2025

- **Upconverting microgauges reveal intraluminal force dynamics in vivo.** *Nature*
  Casar, J. R., McLellan, C. A., Shi, C., Stiber, A., Lay, A., Siefe, C., Parakh, A., Gaerlan, M., Gu, X. W., Goodman, M. B., Dionne, J. A.
  2025; 637 (8044): 76-83
- **C. elegans touch receptor neurons direct mechanosensory complex organization via repurposing conserved basal lamina proteins.** *Current biology : CB*
  Das, A., Franco, J. A., Mulcahy, B., Wang, L., Chapman, D., Jaisinghani, C., Pruitt, B. L., Zhen, M., Goodman, M. B.
  2024
- **A high-throughput behavioral screening platform for measuring chemotaxis by C. elegans.** *PLoS biology*
  Fryer, E., Guha, S., Rogel-Hernandez, L. E., Logan-Garbisch, T., Farah, H., Rezaei, E., Mollhoff, I. N., Nekimken, A. L., Xu, A., Seyahi, L. S., Fechner, S., Druckmann, S., Clandinin, et al
  2024; 22 (6): e3002672
- **Mechanosensitive membrane proteins: Usual and unusual suspects in mediating mechanotransduction.** *The Journal of general physiology*
  Goodman, M. B., Haswell, E. S., Vásquez, V.
  2023; 155 (3)
- **Visualizing Neurons Under Tension In Vivo with Optogenetic Molecular Force Sensors.** *Methods in molecular biology (Clifton, N.J.)*
  Sanfeliu-Cerdán, N., Lin, L. C., Dunn, A. R., Goodman, M. B., Krieg, M.
  2023; 2600: 239-266
- **Image-based axon model highlights heterogeneity in initiation of damage.** *Biophysical journal*
  Wang, L. M., Goodman, M. B., Kuhl, E.
  2022
- **Engineering Bright and Mechanosensitive Alkaline-Earth Rare-Earth Upconverting Nanoparticles.** *The journal of physical chemistry letters*
  McLellan, C. A., Siefe, C., Casar, J. R., Peng, C. S., Fischer, S., Lay, A., Parakh, A., Ke, F., Gu, X. W., Mao, W., Chu, S., Goodman, M. B., Dionne, et al
  2022: 1547-1553
- **Reciprocal Interactions Between TGF-beta Signaling and Collagens - Insights from C. elegans.** *Developmental dynamics : an official publication of the American Association of Anatomists*
  Goodman, M. B., Savage-Dunn, C.
  2021
- **DEG/ENaC/ASIC channels vary in their sensitivity to anti-hypertensive and non-steroidal anti-inflammatory drugs.** *The Journal of general physiology*
  Fechner, S., D'Alessandro, I., Wang, L., Tower, C., Tao, L., Goodman, M. B.
  2021; 153 (4)
- **Nanoscale Structure and Mechanics of Skin in a C. elegans Model of Touch Sensation**
  Rezaeil, E., Savage-Dunn, C., Goodman, M. B.
  CELL PRESS.2021: 234A–235A
- **Expansion microscopy of C. elegans.** *eLife*
  Yu, C. J., Barry, N. C., Wassie, A. T., Sinha, A., Bhattacharya, A., Asano, S., Zhang, C., Chen, F., Hobert, O., Goodman, M. B., Haspel, G., Boyden, E. S.
  2020; 9
- **The plant terpenoid carvone is a chemotaxis repellent for C. elegans.** *microPublication. Biology*
  Ellington, C., Hayden, A., LaGrange, Z., Luccioni, M., Osman, M., Ramlan, L., Vogt, M., Guha, S., Goodman, M., O'Connell, L.
  2020; 2020
- **Touch-induced Mechanical Strain in Somatosensory Neurons is Independent of Extracellular Matrix Mutations in C. elegans.** *Molecular biology of the cell*
  Nekimken, A. L., Pruitt, B. L., Goodman, M. B.
  2020: mbcE20010049
- **Alkaline-earth Rare-earth Upconverting Nanoparticles as Bio-compatible Mechanical Force Sensors**
  McLellan, C. A., Siefe, C. P., Fischer, S., Casar, J. R., Swearer, D. F., Goodman, M. B., Dionne, J. A., IEEE

IEEE.2020

- **Opportunities and challenges in achieving co-management in marine protected areas in East Africa: a comparative case study** *Journal of the Indian Ocean Region*
  O'Leary, J. K., Goodman, M., Tuda, A., Machumu, M., West, L.
  2020
- **Parallel Processing of Two Mechanosensory Modalities by a Single Neuron in C.elegans.** *Developmental cell*
  Tao, L., Porto, D., Li, Z., Fechner, S., Lee, S. A., Goodman, M. B., Xu, X. Z., Lu, H., Shen, K.
  2019
- **Progressive recruitment of distal MEC-4 channels determines touch response strength in C. elegans.** *The Journal of general physiology*
  Katta, S., Sanzeni, A., Das, A., Vergassola, M., Goodman, M. B.
  2019
- **Somatosensory neurons integrate the geometry of skin deformation and mechanotransduction channels to shape touch sensing.** *eLife*
  Sanzeni, A., Katta, S., Petzold, B., Pruitt, B. L., Goodman, M. B., Vergassola, M.
  2019; 8
- **Optically Robust and Biocompatible Mechanosensitive Upconverting Nanoparticles** *ACS CENTRAL SCIENCE*
  Lay, A., Sheppard, O. H., Siefe, C., McLellan, C. A., Mehlenbacher, R. D., Fischer, S., Goodman, M. B., Dionne, J. A.
  2019; 5 (7): 1211–22
- **Optically Robust and Biocompatible Mechanosensitive Upconverting Nanoparticles.** *ACS central science*
  Lay, A., Sheppard, O. H., Siefe, C., McLellan, C. A., Mehlenbacher, R. D., Fischer, S., Goodman, M. B., Dionne, J. A.
  2019; 5 (7): 1211-1222
- **How Caenorhabditis elegans Senses Mechanical Stress, Temperature, and Other Physical Stimuli.** *Genetics*
  Goodman, M. B., Sengupta, P.
  2019; 212 (1): 25–51
- **How Caenorhabditis elegans Senses Mechanical Stress, Temperature, and Other Physical Stimuli** *GENETICS*
  Goodman, M. B., Sengupta, P.
  2019; 212 (1): 25–51
- **Funders should evaluate projects, not people** *LANCET*
  Raymond, J. L., Goodman, M. B.
  2019; 393 (10171): 494–95
- **Funders should evaluate projects, not people.** *Lancet (London, England)*
  Raymond, J. L., Goodman, M. B.
  2019; 393 (10171): 494–95
- **Synaptic Communication upon Gentle Touch.** *Neuron*
  Fechner, S., Goodman, M. B.
  2018; 100 (6): 1272–74
- **Mechanosensitive upconverting nanoparticles for visualizing mechanical forces in vivo**
  Lay, A., Siefe, C., Fischer, S., Mehlenbacher, R., Das, A., Nekimken, A., Ke, F., Mao, W., Pruitt, B., Cohen, B., Alivisatos, P., Goodman, M., Dionne, et al
  AMER CHEMICAL SOC.2018
- **The tactile receptive fields of freely moving Caenorhabditis elegans nematodes** *INTEGRATIVE BIOLOGY*
  Mazzochette, E. A., Nekimken, A. L., Loizeau, F., Whitworth, J., Huynh, B., Goodman, M. B., Pruitt, B. L.
  2018; 10 (8): 450–63
- **The tactile receptive fields of freely moving Caenorhabditis elegans nematodes.** *Integrative biology : quantitative biosciences from nano to macro*
  Mazzochette, E. A., Nekimken, A. L., Loizeau, F., Whitworth, J., Huynh, B., Goodman, M. B., Pruitt, B. L.
  2018

- **Immunofluorescence reveals neuron-specific promoter activity in non-neuronal cells.** *microPublication. Biology*
  Lear, S. K., Das, A., Goodman, M. B.
  2018; 2018
- **Loss of CaMKI function disrupts salt aversive learning in C. elegans.** *The Journal of neuroscience : the official journal of the Society for Neuroscience*
  Lim, J. P., Fehlauer, H., Das, A., Saro, G., Glauser, D. A., Brunet, A., Goodman, M. B.
  2018
- **The extraordinary AFD thermosensor of C-elegans** *PFLUGERS ARCHIV-EUROPEAN JOURNAL OF PHYSIOLOGY*
  Goodman, M. B., Sengupta, P.
  2018; 470 (5): 839–49
- **Ultrasound Elicits Behavioral Responses through Mechanical Effects on Neurons and Ion Channels in a Simple Nervous System** *JOURNAL OF NEUROSCIENCE*
  Kubanek, J., Shukla, P., Das, A., Baccus, S. A., Goodman, M. B.
  2018; 38 (12): 3081–91
- **Using a Microfluidics Device for Mechanical Stimulation and High Resolution Imaging of C. elegans** *JOVE-JOURNAL OF VISUALIZED EXPERIMENTS*
  Fehlauer, H., Nekimken, A. L., Kim, A. A., Pruitt, B. L., Goodman, M. B., Krieg, M.
  2018
- **Bright, Mechanosensitive Upconversion with Cubic-Phase Heteroepitaxial Core-Shell Nanoparticles.** *Nano letters*
  Lay, A. n., Siefe, C. n., Fischer, S. n., Mehlenbacher, R. D., Ke, F. n., Mao, W. L., Alivisatos, A. P., Goodman, M. B., Dionne, J. A.
  2018
- **Forces applied during classical touch assays for Caenorhabditis elegans** *PLOS ONE*
  Nekimken, A. L., Mazzochette, E. A., Goodman, M. B., Pruitt, B. L.
  2017; 12 (5)
- **Pneumatic stimulation of C. elegans mechanoreceptor neurons in a microfluidic trap.** *Lab on a chip*
  Nekimken, A. L., Fehlauer, H., Kim, A. A., Manosalvas-Kjono, S. N., Ladpli, P., Memon, F., Gopisetty, D., Sanchez, V., Goodman, M. B., Pruitt, B. L., Krieg, M.
  2017
- **Genetic defects in beta-spectrin and tau sensitize C.elegans axons to movement-induced damage via torque-tension coupling** *ELIFE*
  Krieg, M., Stuehmer, J., Cueva, J. G., Fetter, R., Spilker, K., Cremers, D., Shen, K., Dunn, A. R., Goodman, M. B.
  2017; 6
- **Molecules empowering animals to sense and respond to temperature in changing environments** *CURRENT OPINION IN NEUROBIOLOGY*
  Glauser, D. A., Goodman, M. B.
  2016; 41: 92-98
- **The tubulin repertoire of Caenorhabditis elegans sensory neurons and its context-dependent role in process outgrowth** *MOLECULAR BIOLOGY OF THE CELL*
  Lockhead, D., Schwarz, E. M., O'Hagan, R., Bellotti, S., Krieg, M., Barr, M. M., Dunn, A. R., Sternberg, P. W., Goodman, M. B.
  2016; 27 (23): 3717-3728
- **Grabbing brain activity on the go.** *Proceedings of the National Academy of Sciences of the United States of America*
  Clandinin, T. R., Goodman, M. B.
  2016; 113 (8): 1965-7
- **Tissue mechanics govern the rapidly adapting and symmetrical response to touch** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Eastwood, A. L., Sanzeni, A., Petzold, B. C., Park, S., Vergassola, M., Pruitt, B. L., Goodman, M. B.
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- **Feeling force: physical and physiological principles enabling sensory mechanotransduction.** *Annual review of cell and developmental biology*
  Katta, S., Krieg, M., Goodman, M. B.

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- **Mechanical systems biology of C. elegans touch sensation.** *BioEssays*
  Krieg, M., Dunn, A. R., Goodman, M. B.
  2015; 37 (3): 335-344
- **FBN-1, a fibrillin-related protein, is required for resistance of the epidermis to mechanical deformation during C. elegans embryogenesis.** *eLife*
  Kelley, M., Yochem, J., Krieg, M., Calixto, A., Heiman, M. G., Kuzmanov, A., Meli, V., Chalfie, M., Goodman, M. B., Shaham, S., Frand, A., Fay, D. S.
  2015; 4
- **Feeling Force: Physical and Physiological Principles Enabling Sensory Mechanotransduction** *ANNUAL REVIEW OF CELL AND DEVELOPMENTAL BIOLOGY, VOL 31*
  Katta, S., Krieg, M., Goodman, M. B.
  2015; 31: 347-371
- **CaMKI-Dependent Regulation of Sensory Gene Expression Mediates Experience-Dependent Plasticity in the Operating Range of a Thermosensory Neuron** *NEURON*
  Yu, Y. V., Bell, H. W., Glauser, D. A., Van Hooser, S. D., Goodman, M. B., Sengupta, P.
  2014; 84 (5): 919-926
- **The Balance between Cytoplasmic and Nuclear CaM Kinase-1 Signaling Controls the Operating Range of Noxious Heat Avoidance** *NEURON*
  Schild, L. C., Zbinden, L., Bell, H. W., Yu, Y. V., Sengupta, P., Goodman, M. B., Glauser, D. A.
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- **Mechanical control of the sense of touch by ß-spectrin.** *Nature cell biology*
  Krieg, M., Dunn, A. R., Goodman, M. B.
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- **Mechanical control of the sense of touch by ß-spectrin.** *Nature cell biology*
  Krieg, M., Dunn, A. R., Goodman, M. B.
  2014; 16 (3): 224-233
- **Bidirectional thermotaxis in Caenorhabditis elegans is mediated by distinct sensorimotor strategies driven by the AFD thermosensory neurons** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Luo, L., Cook, N., Venkatachalam, V., Martinez-Velazquez, L. A., Zhang, X., Calvo, A. C., Hawk, J., MacInnis, B. L., Frank, M., Ng, J. H., Klein, M., Gershow, M., Hammarlund, et al
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- **Phospholipids that Contain Polyunsaturated Fatty Acids Enhance Neuronal Cell Mechanics and Touch Sensation.** *Cell reports*
  Vásquez, V., Krieg, M., Lockhead, D., Goodman, M. B.
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- **PTRN-1, a microtubule minus end-binding CAMSAP homolog, promotes microtubule function in Caenorhabditis elegans neurons.** *eLife*
  Richardson, C. E., Spilker, K. A., Cueva, J. G., Perrino, J., Goodman, M. B., Shen, K.
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- **PTRN-1, a microtubule minus end-binding CAMSAP homolog, promotes microtubule function in Caenorhabditis elegans neurons.** *eLife*
  Richardson, C. E., Spilker, K. A., Cueva, J. G., Perrino, J., Goodman, M. B., Shen, K.
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- **Thermotaxis navigation behavior.** *WormBook : the online review of C. elegans biology*
  Goodman, M. B., Klein, M., Lasse, S., Luo, L., Mori, I., Samuel, A., Sengupta, P., Wang, D.
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- **GCY-8, PDE-2, and NCS-1 are critical elements of the cGMP-dependent thermotransduction cascade in the AFD neurons responsible for C. elegans thermotaxis** *JOURNAL OF GENERAL PHYSIOLOGY*
  Wang, D., O'Halloran, D., Goodman, M. B.
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- **Identification of 526 Conserved Metazoan Genetic Innovations Exposes a New Role for Cofactor E-like in Neuronal Microtubule Homeostasis** *PLOS GENETICS*
  Frederic, M. Y., Lundin, V. F., Whiteside, M. D., Cueva, J. G., Tu, D. K., Kang, S. Y., Singh, H., Baillie, D. L., Hutter, H., Goodman, M. B., Brinkman, F. S., Leroux, M. R.
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  Petzold, B. C., Park, S., Mazzochette, E. A., Goodman, M. B., Pruitt, B. L.
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- **The doublecortin-related gene zyg-8 is a microtubule organizer in Caenorhabditis elegans neurons** *JOURNAL OF CELL SCIENCE*
  Bellanger, J., Cueva, J. G., Baran, R., Tang, G., Goodman, M. B., Debant, A.
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- **Insight into DEG/ENaC Channel Gating from Genetics and Structure** *PHYSIOLOGY*
  Eastwood, A. L., Goodman, M. B.
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- **Posttranslational Acetylation of alpha-Tubulin Constrains Protofilament Number in Native Microtubules** *CURRENT BIOLOGY*
  Cueva, J. G., Hsin, J., Huang, K. C., Goodman, M. B.
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- **How We Feel: Ion Channel Partnerships that Detect Mechanical Inputs and Give Rise to Touch and Pain Perception** *NEURON*
  Geffeney, S. L., Goodman, M. B.
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- **Electrophysiological Methods for Caenorhabditis elegans Neurobiology** *CAENORHABDITIS ELEGANS: CELL BIOLOGY AND PHYSIOLOGY, SECOND EDITION*
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  Glauser, D. A., Johnson, B. E., Aldrich, R. W., Goodman, M. B.
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- **Alternatively spliced domains interact to regulate BK potassium channel gating** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
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- **The DEG/ENaC Protein MEC-10 Regulates the Transduction Channel Complex in Caenorhabditis elegans Touch Receptor Neurons** *JOURNAL OF NEUROSCIENCE*
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- **Running hot and cold: behavioral strategies, neural circuits, and the molecular machinery for thermotaxis in C. elegans and Drosophila** *GENES & DEVELOPMENT*
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