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Education

- Post-doctoral Fellow in Neuroscience; Mentor: Dr. Yishi Jin, UC Santa Cruz, HHMI 1996-2000
- PhD in Biochemistry; Mentor: Dr. Peter Candido, University of British Columbia 1990-1995
- BSc in Biochemistry, Wuhan University, China 1986-1990

Academic Appointments

- Visiting Professor, Harvard University 2020-
- Professor of Molecular Genetics, Physiology, Cell and Systems Biology, University of Toronto 2012-
- Senior Scientist, the Lunenfeld-Tanenbaum Research Institute 2006-
- Associate Professor of Molecular Genetics, Physiology, University of Toronto 2006-2012
- Scientist, the Lunenfeld-Tanenbaum Research Institute 2001-2006
- Assistant Professor of Molecular Genetics, University of Toronto 2001-2006

Leadership Appointments

- Co-Director, the Nanoscale Biomedical Imaging Facility, Sinai Health System and the Hospital for Sick Children 2018-
- Director, the Optical Imaging Facility, Centre for Integrative Molecular, Cellular and Behavioral Systems, Lunenfeld-Tanenbaum Research Institute 2018-

Distinctions

- Tier 1 Canada Research Chair in Neural Circuit Development and Function 2018-2025
- Lloyd S. D. Fogler QC Award of Excellence Award 2014-2015
- Fellow, The Radcliffe Institute for Advanced Study, Harvard University 2013-2014
- Lawrence and Judy Tanenbaum Research Chair in Neuroscience 2008-2011
- Mobility Program in Science and Technology, Government of France 2008
- Early Researcher Award, Ontario Ministry of Research and Innovation 2007-2011
- EJLB Scholar, the EJLB Foundation 2007-2010
- PetroCanada Young Innovator Award 2006-2007
- Early Researcher Award, Samuel Lunenfeld Research Institute 2006
- Tier 2 Canada Research Chair in Neuroscience 2001-2011
- Human Frontier Science Fellowship Long-term Post-doctoral Fellowship 1996-1998
- University Graduate Fellowship, University of British Columbia 1991-1995

Service

- Graduate Advisory Team, Department of Molecular Genetics, University of Toronto 2019-
- Graduate Admissions Committee, Department of Molecular Genetics, University of Toronto 2018-
- Advisory Board Member, WormBase 2018-
- Steering Committee, Research Coordination Network on Comparative Neurobiology, NSF 2017-
- Review Committee, Canadian Gairdner Foundation 2015-2018
- Review Committee, Radcliffe Institute, Harvard University 2014-
- Graduate Admissions Committee, Department of Physiology, University of Toronto 2014-2016
- Graduate Awards Committee, Department of Physiology, University of Toronto 2014-2016
- Graduate Awards Committee, Department of Molecular Genetics, University of Toronto 2010-2017
- Scholarship Committee, Ontario Graduate Scholarship 2008-2010
- Steering Committee, Collaborative Graduate Program in Developmental Biology, University of Toronto 2006-2012
- Scholarship Committee, School of Graduate Studies, University of Toronto 2006-2007
- Reviewer for Journals (Nature, Science, Neuron, eLife, Current Biology, Nature Methods, PLoS Genetics, PLoS Biology, Development, Genetics) 2001-
- Reviewer for Grant Panels (NIH, NSF, the Brain Initiative, CIHR, CRC, NSERC, ERC, Human Frontier Science Program, Allen Foundation) 2001-
- Supervisory Committee Member for thesis studies (BSc, MSc, PhD), University of Toronto 2001-

International Conferences and Courses

- Scientific Course Lecturer and Consultant, Neural Systems & Behaviour, MBL 2018
- Co-organizer, International *C. elegans* meetings and workshops 2008-2017
- Co-organizer, American Society for Cell Biology 2013
- Program Advisor, 2012 Gairdner Award Neural Symposium 2012
- Neural Symposium, Lunenfeld-Tanenbaum Research Institute 2011
- Coordinator and Instructor, *C. elegans* course, Cold Spring Harbor Laboratory 2008-2010

Teaching

International

- Neural Systems & Behavior, Marine Biological Laboratory, Woods Hole, MA, USA
- *C. elegans*, Cold Spring Harbor Laboratory, Cold Spring, NY, USA
- Developmental Neurobiology, Okinawa Institute of Science and Technology, Japan

University of Toronto

- Comparative Connectomics Using Random Graph Theory (Summer Undergraduate Data Science Research Program, Data Sciences Institute)
- JDB1025H: Developmental Biology (Collaborative Program in Developmental Biology)
- JYG1555H: Cellular and Molecular Neurobiology (Physiology)
- MMG1012H: Advanced Imaging: Techniques and Application in Biological Systems (Molecular Genetics)
- MMG1012H: Developmental Neurobiology (Molecular Genetics)
- MGY480Y: Undergraduate Research Thesis Course (Fourth Year)

- MGY399Y: Undergraduate Research Opportunity Program (Third Year)
- MGY299Y: Undergraduate Research Opportunity Program (Second Year)

Publications

(*: shared correspondence)

Connectomics

- Mulcahy B, Witvliet D, Mitchell JM, Schalek RL, Berger D, Wu Y, Holmyard D, Lu Y, Ahamed T, Samuel ADT, Chisholm AD, Lichtman JW, Zhen M. (2022). **Post-embryonic maturation of the *C. elegans* motor circuit.** Under review.
- Varga BV, Faiz M, Yang H, Pivonkova H, Gao S, Khelifi G, Linderoth E, Zhen M, Hussein SM, Nagy A. (2022). **Signal requirement for cortical potential of transplantable human neuroepithelial stem cells.** Accepted, *Nature Communications*.
- Witvliet D, Mulcahy B, Mitchell JM, Meirovitch Y, Berger DR, Wu Y, Liu Y, Koh WR, Parvathala R, Holmyard D, Schalek RL, Shavit N, Chisholm AD, Lichtman JW*, Samuel ADT*, Zhen M* (2021) **Connectomes across development reveal principles of brain maturation in *C. elegans*.** *Nature* 596: 257-261. PMID 34349261.
- Britz S, Markert SM, Witvliet D, Steyer AM, Tröger S, Mulcahy B, Kollmannsberger P, Schwab Y, Zhen M, Stigloher C. (2021). **Structural analysis of the *C. elegans* dauer larval anterior sensilla by Focused Ion Beam-Scanning Electron Microscopy.** *Frontiers in Neuroanatomy* 15:732520. PMID: 34819841
- Cuentas-Condori A, Mulcahy B, He S, Palumbos S, Zhen M, Miller DM III. (2019) ***C. elegans* neurons have functional dendritic spines** *eLife* 8: e47918. PMID: 31584430.
- Mulcahy B*, Witvliet D, Holmyard D, Mitchell J, Chisholm A, Samuel ADT*, Zhen M*. (2018) **A Pipeline for Volume Electron Microscopy of the *Caenorhabditis elegans* Nervous System.** *Frontiers in Neural Circuits* 12:94. PMID: 30949033.
- Kaldorf KV, Theiss M, Markert SM, Zhen M, Dandekar T, Stigloher C, Kollmannsberger P. (2018) **Automated classification of synaptic vesicles in electron tomograms of *C. elegans* using machine learning.** *PLoS One Computational Biology* 13(10):e0205348. PMID: 30296290.
- Markert SM, Britz S, Proppert S, Lang M, Witvliet D, Mulcahy B, Sauer M, Zhen M, Bessereau JL, Stigloher C. (2016) **Filling the gap: adding super-resolution to array tomography for correlated ultrastructural and molecular identification of electrical synapses at the *C. elegans* connectome.** *Neurophotonics* 3(4): 041802. PMID: 27175373.

Circuits

- Lu Y, Ahamed T, Mulcahy B, Witvliet D, Guan SA, Hung W, Meng J, Wen Q, Samuel ADT, Zhen M.* (2021). **Extrasynaptic signaling enables an asymmetric juvenile motor circuit to produce a symmetric gait.** Under review.
- Chen L, Liu Y, Su P, Hung W, Li H, Wang Y, Yue Z, Ge M, Wu Z, Zhang Y, Fei P, Chen L, Tao L, Mao H, Zhen M, Gao S. (2021). **Escape Steering by Cholecystinin Peptidergic Signaling.** *Cell Reports* 38(6): 110330. PMID: 35139370.

- Susoy V, Hung W, Witvliet D, Whitener JE, Wu M, Graham BJ, Zhen M, Venkatachalam V, Samuel ADT. (2021). **Natural sensory context drives diverse brain-wide activity during *C. elegans* mating.** *Cell* 184(20): 5122-5137.e17. PMID: 34534446
- Ji N, Venkatachalam V, Rodgers H, Hung W, Kawano T, Clark C, Lim M, Alkema MJ*, Zhen M*, Samuel ADT*. (2021) **Corollary discharge promotes a sustained motor state in a neural circuit for navigation.** *eLife* 2021;10:e68848. PMID: 33880993
- Yuan W, Zhang X, Qi X, Hung W, Florman J, Huo J, Xu T, Xie Y, Alkema M, Zhen M, Wen Q (2020) **Flexible motor sequence generation during stereotyped escape responses.** *eLife* 2020;9:e56942/ PMID: 32501216. PMCID: PMC7338056.
- Ao Y, Zeng K, Yu B, Miao Y, Hung W, Zhen M, Yang X, Zhang Y, Gao S. (2019) **An Upconversion Nanoparticle Enables Near Infrared-Optogenetic Manipulation of the *C. elegans* Motor Circuit.** *ACS Nano* 13(3): 3373-3386. PMID: 30681836.
- Wen Q*, Gao S*, Zhen M*. (2018) ***C. elegans* excitatory ventral cord motor neurons derive rhythm for body undulation.** *Phil. Trans. R. Soc. B.* 373(1758). PMID: 30201835.
- Xu T, Huo J, Shao S, Po M, Kawano T, Lu Y, Qu M, Zhen M, Wen Q. (2018) **A descending pathway through electrical coupling facilitates undulatory wave propagation in *C. elegans*.** *PNAS* 115(19): E4493-E4502. PMID: 29686107.
- Gao S*, Guan S, Fouad AD, Meng J, Huang Y, Li Y, Alcaire S, Hung W, Kawano T, Lu Y, Qi YB, Jin Y, Alkema M, Fang-Yen C, Zhen M*. (2018) **Excitatory Motor Neurons are Local Oscillators for Reverse Locomotion.** *eLife* 6:e299915. PMID: 29360035.
- Lim MA*, Chitturi J, Laskova V, Meng, J, Findeis D, Wiekenbert A, Mulcahy B, Luo L, Li Y, Lu Y, Hung W, Qu Y, Ho C, Holmyard D, McWhirter R, Ni J, Samuel ADT, Miller DM, Schnabel R, Calarco JA, Zhen M*. (2016) **Neuroendocrine modulation sustains the *C. elegans* forward motor state.** *eLife.* e19887, 2016. PMID: 27855782. PMCID: PMC5120884.
- Venkatachalam V*, Ji N, Wang X, Clark C, Mitchell JK, Klein M, Tabone CJ, Florman J, Ji H, Greenwood J, Chisholm AD, Srinivasan J, Alkema M*, Zhen M*, Samuel ADT*. (2016) **Pan-neuronal imaging in roaming *Caenorhabditis elegans*.** *PNAS* 113(8): E1082-8. PMID: 26711989. PMCID: PMC4776525.
- Ardeshiri R, Mulcahy B, Zhen M, Rezai P. (2016) **A Hybrid Microfluidic Device for On-demand Orientation and Multidirectional Imaging of *C. elegans* Organs and Neurons.** *Biomicrofluidics* 10(6): 064111. eCollection 2016. PMID: 27990213. PMCID: PMC5135714.
- Zhen M* and Samuel ADT.* (2015) ***C. elegans* locomotion: small circuits, complex functions.** *Curr Opin Neurobiol.* 33:117-126. PMID: 25845627.
- Wen Q, Po MD, Hulme E, Chen S, Liu X, Kowk SW, Gershow M, Leifer AM, Butler V, Fang-Yen C, Kawano T, Schafer WR, Whitesides G, Wyart M, Chklovskii DB, Zhen M, Samuel, ADT (2012) **Proprioceptive coupling within motor neurons drives *C. elegans* forward locomotion.** *Neuron* 76(4): 750-761. PMID: 23177960.

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- Gao S and Zhen M.* (2011) **Action potentials drive body wall muscle contractions in *Caenorhabditis elegans*.** *PNAS* 108(6): 2557-2562. PMID: 21248227.
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Methods

- Dong XK, Kheiri K, Lu YN, Xu ZY, Zhen M, Liu XY. (2021). **Towards a live soft microrobot: optogenetic locomotion control of *Caenorhabditis elegans*.** *Science Robotics* 6(55): eabe3950. PMID: 34193562.
- Wang Z, Zhu L, Zhang H, Li G, Li C, Yi L, Yang Y, Ding Y, Zhen M, Gao S, Hsiai T, Fei P. (2021) **Real-time volumetric reconstruction of biological dynamics with light-field microscopy and deep learning.** *Nature Methods*. 18: 551-556. PMID: 33574612.
- Zhao F, Yang Y, Li Y, Jiang H, Xie X, Yu T, Wang X, Liu Q, Zhang H, Jia H, Liu S, Zhen M, Zhu D, Gao S, Fei P. (2020) **Efficient and cost-effective 3D cellular imaging by sub-voxel-resolving light-sheet add-on microscopy.** *J. Biophotonics* 13(6):e201960243. PMID: 32077244.
- Luyben TT, Rai J, Li H, Georgiou J, Avila A, Zhen M, Collingridge GL, Tominaga T, Okamoto K (2020) **Optogenetic manipulation of postsynaptic cAMP using a novel transgenic mouse line enables synaptic plasticity and enhanced depolarization in the hippocampal dentate gyrus.** *Frontiers in Neural Circuits* 14, No. 24. PMID: 32581725. PMCID: PMC7283606.

Neuronal Excitability

- Gao S*, Xie L, Kawano T, Po MD, Pirri J, Guan S, Alkema M, Zhen M*. (2015) **The NCA sodium leak channel is required for persistent motor circuit activity that sustains locomotion.** *Nature Communications* 6: 6323. PMID: 25716181.
- Qi Y, Po MD, Mac P, Kawano T, Jorgensen EM, Zhen M, Jin Y. (2013) **Hyperactivation of B-type motor neurons results in aberrant synchrony of the *C. elegans* motor circuit.** *Journal of Neuroscience* 33(12): 5319-5325. PMID: 23516296.
- Xie L, Gao S, Alcaire SM, Aoyagi K, Wang Y, Griffin JK, Stagljar I, Nagamatsu S, Zhen M* (2013) **NLF-1 Delivers a Sodium Leak Channel to Regulate Neuronal Excitability and Modulate Rhythmic Locomotion.** *Neuron* 77(6): 1069-1082. PMID: 23522043.
- Bouhours M, Po MD, Gao S, Hung W, Li H, Georgiou J, Roder JC, Zhen M* (2011) **A Co-operative Regulation of Neuronal Excitability by UNC-7 Innexin and NCA/NALCN Leak Channel.** *Molecular Brain* 4:16. PMID: 21489288.
- Sancar F, Touroutine D, Gao S, Oh HJ, Gendrel M, Bessereau JL, Kim H, Zhen M, Richmond JE. (2011) **The dystrophin-associated protein complex maintains muscle excitability by regulating Ca(2+)-dependent K(+) (BK) channel localization.** *Journal of Biological Chemistry* 286(38): 33501-10. PMID: 21795674.

- Yeh E, Ng S, Zhang M, Bouhours M, Wang Y, Wang M, Hung W, Aoyagi K, Melnik-Martine, K, Li M, Liu F, Schafer WR, Zhen M* (2008) **A putative cation channel, NCA-1, and a novel protein, UNC-80, transmit neuronal activity in *C. elegans*.** *PLoS Biology* 6(3) e55. PMID: 18336069.

Neural Development and Synaptic Transmission

- Tien C, Yu B, Huang M, Stepien K, Sugita K, Xie X, Han L, Monnier P, Zhen M, Rizo J, Gao S, Sugita S. (2020). **Open syntaxin overcomes synaptic transmission defects in diverse *C. elegans* exocytosis mutants.** *Nature Communications* 11(5516). PMID: 33139696.
- Huang YC, Pirri JK, Rayes D, Gao S, Mulcahy B, Grant J, Saheki Y, Francis MM, Zhen M, Alkema AJ. (2020) **Gain-of-function mutations in the UNC-2/CaV2 α channel lead to hyperactivity and excitation-dominant synaptic transmission in *Caenorhabditis elegans*** *eLife* 2019; 8:e45905. PMID: 31364988.
- Park S, Bin NR, Yu B, et al. Feng ZP, Monnier P, Sun HS, Zhen M, Gao S, Rizo J, Sugita S. (2017) **UNC-18 and Tomosyn antagonistically control synaptic vesicle priming downstream of UNC-13 in *C. elegans*.** *J Neurosci.* 37(36): 8797-8815. PMID: 28821673.
- Opperman KJ, Mulcahy B, Giles AC, Risley M, Birnbaum RL, Tulgren ED, Dawson-Scully K, Zhen M, Grill B. (2017) **The HECT family ubiquitin ligase EEL-1 regulates neuronal function and development.** *Cell Reports* 19: 822-835. PMID: 28445732.
- Meng J, Ma X, Tao H, JPin X, Witvliet D, Zhu M, Dong M, Zhen M, Jin Y, Qi YB. (2017) **Myrf ER-Bound Transcription Factors Drive *C. elegans* Synaptic Plasticity via Cleavage-Dependent Nuclear Translocation.** *Developmental Cell* 41: 180-194. PMID: 28441531.
- Park S, Bin NR, Michael Rajah M, Kim B, Chou TC, Kang SY, Sugita K, Parsaud L, Smith M, Monnier PP, Ikura M, Zhen M, Sugita S. (2015) **Conformational states of syntaxin-1 govern the necessity of N-peptide binding in exocytosis of PC12 cells and *Caenorhabditis elegans*.** *Mol Biol Cell* 27(4): 669-85. PMID: 26700321. PMCID: PMC4750926.
- Maro GS, Gao S, Olechwier AM, Hung WL, Liu M, Özkan E, Zhen M,* Shen K* (2015) **MADD-4/Punctin and Neurexin Organize the *C. elegans* GABAergic Postsynapses through Neuroligin.** *Neuron* 86: 1420-1432. PMID: 26028574.
- Wang J, Chitturi, J, Ge Q, Laskova V, Li X, Ding M, Zhen M,* Huang X*. (2015) **The *C. elegans* COE Transcription Factor UNC-3 Activates Lineage-Specific Apoptosis and Affects Neurite Growth.** *Development* 142(8): 1447-57. PMID: 25790851.
- Norris AD, Gao S, Norris ML, Ray D, Ramani AK, Fraser AG, Morris Q, Hughes TR, Zhen M*, Calarco, JA*. (2014) **A Pair of RNA-Binding Proteins Controls Networks of Splicing Events Contributing to Specialization of Neural Cell Types.** *Molecular Cell* 54(6): 946-59. PMID: 24910101.
- Hung WL, Hwang, C, Gao S, Liao EH, Chitturi J, Wang Y, Li H, Stigloher C, Bessereau JL, Zhen M.* (2013) **Attenuation of Insulin Signaling Contributes to FSN-1-mediated Regulation of Synapse Development.** *EMBO J.* 32(12): 1745-1760. PMID: 23665919.

- Najarro EH, Wong L, Zhen M, Carpio EP, Goncharov A, Garriga G, Lundquist EA, Jin Y, Ackley BD. (2012) ***C. elegans* Flamingo Cadherin FMI-1 Regulates GABAergic Neuronal Development.** *Journal of Neuroscience* 32(12): 4196-211. PMID: 22442082.
- Po MD*, Calarco JA*, Zhen M*. (2012) **Releasing the inner inhibition for axon regeneration.** *Neuron* 73(2): 207-9. PMID: 22284174.
- Stigloher C, Zhan H, Zhen M, Richmond J, Bessereau JL. (2011) **The presynaptic dense projection of the *Caenorhabditis elegans* cholinergic neuromuscular junction localizes synaptic vesicles at the active zone through SYD-2/liprin and UNC-10/RIM-dependent interactions.** *Journal of Neuroscience* 31(12): 4388-4396. PMID: 21430140.
- Kim JS*, Hung W, Zhen M*. (2010) **The Long and the Short of SAD-1 Kinase.** *Communicative and Integrative Biology* 3(3): 1-5. PMID: 20714407.
- Po MD, Hwang C, Zhen M*. (2010) **PHRs: bridging axon guidance, outgrowth and synapse development.** *Current Opinion in Neurobiology* 20(1): 100-7. PMID: 20079626.
- Kim JSM, Hung W, Narbonne P, Roy R, Zhen M*. (2010) ***C. elegans* STRAD α and SAD Cooperatively Regulate Neuronal Polarity and Synaptic Organization.** *Development* 137(1): 93-102. PMID: 20023164.
- Yeh E, Kawano T, Ng S, Fetter R, Hung W, Wang Y, Zhen M* (2009) ***C. elegans* Innexins Regulate Active Zone Differentiation.** *Journal of Neuroscience* 29(16): 5207-17. PMID: 19386917.
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- Wang W, Bouhours M, Gracheva EO, Liao EH, Xu K, Sengar A, Xin X, Roder J, Boone C, Richmond JE, Zhen M and Egan SE (2008) **ITSN-1 Controls Vesicle Recycling at the Neuromuscular Junction and Functions in Parallel with DAB-1.** *Traffic* 9(5): 742–54. PMID: 18298590.
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- Wang Y, Gracheva EO, Richmond J, Kawano T, Couto JM, Calarco JA, Vijayaratnam V, Jin Y, Zhen M* (2006) **The C2H2 zinc-finger protein SYD-9 is a putative post-transcriptional regulator for synaptic transmission.** *PNAS* 103(27): 10450-10455. PMID: 16803962.
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- Yeh E, Kawano T, Weimer RM, Bessereau JL, Zhen M* (2005) **Identification of genes involved in synaptogenesis using a fluorescent active zone marker in *C. elegans*.** *Journal of Neuroscience* 25(15): 3833-41. PMID: 15829635.
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- Zhen M, Huang X, Bamber B, Jin Y. (2000) **Regulation of presynaptic terminal organization by *C. elegans* RPM-1, a putative guanine nucleotide exchanger with a Ring-H2 finger domain.** *Neuron* 26(2): 331-43. PMID: 10839353.
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Diseases and Stem Cells

- Markert SM, Skoruppa M, Yu B, Mulcahy B, Zhen, M, Gao S, Sendtner M, and Stigloher C. (2020) **Overexpression of an ALS-associated FUS mutation in *C. elegans* disrupts NMJ morphology and leads to defective neuromuscular transmission.** *Biology Open* 9(12):bio055129. PMID: 33148607
- Bakooshli MA, Lippmann ES, Mulcahy B, Tung K, Pegoraro E, Ahn H, Ginsberg H, Zhen M, Ashton R, Gilbert PM. (2019) **A 3D model of human skeletal muscle innervated with stem cell-derived motor neurons enables epsilon-subunit targeted Myasthenic Syndrome studies.** *eLife* 2019;8:e4453. PMID: 31084710
- Chitturi J, Hung W, Abdel Rahman AM, Lim MA, Calarco JA, Baran R, Huang X, Dennis J, Zhen M.* (2018) **The UBR-1 ubiquitin ligase regulates glutamate metabolism to generate coordinated motor patters in *Caenorhabditis elegans*.** *PLoS Genetics* 14(4): e1007303. PMID: 29649217.

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- Mok CA*, Heon E, Zhen M*. (2010) **Ciliary dysfunction and obesity.** *Clinical Genetics* 77(1): 18-27. PMID: 19968672.

Roots, Fun, and Friendships

- Lant B, Yu B, Goudreault M, Holmyard D, Knight JDR, Xu P, Zhao L, Chin K, Zhen M, Gingras AC, Derry WB. (2015) **CCM-3/STRIPAK promotes seamless tube extension through endosome recycling.** *Nature Communications* 6:6449(2015). PMID: 25743393.
- Hung WL, Wang Y, Chitturi J, Zhen M*. (2014) **A *C. elegans* Developmental Decision Requires Insulin Signaling-Mediated Neuron-Intestine Communication.** *Development* 141(8): 1767-79. PMID: 24671950.
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