

Petra Anne Levin

Department of Biology

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Education

- 1996-2000 *Postdoctoral Fellow*
Massachusetts Institute of Technology, Department of Biology
Advisor: Dr. Alan Grossman
- 1996 *Ph.D., Biology*
Harvard University, Cambridge, MA
Dissertation: *Asymmetric Division During Spore Formation in Bacillus subtilis.*
Advisor: Dr. Richard Losick
- 1989 *B.A., Biology, Cum laude, with Highest Honors in Biology*
Williams College, Williamstown, MA

Professional

- 2015-present *Professor, Washington University, Department of Biology*
- 2013-present *Co-Director Plant and Microbial Biosciences Graduate Program, Washington University*
- 2008-2015 *Associate Professor, Washington University, Department of Biology*
- 2001-2008 *Assistant Professor, Washington University, Department of Biology*
- 1989-1990 *Science Teacher, The American School in Switzerland*

Select Honors, Fellowships, and Awards

- 2015-2016 Fulbright U.S. Scholar Grant to the Netherlands
- 2014 Division J Lecturer (Cell and Structural Biology), ASM General Meeting, Boston, MA
- 2012-2014 American Society for Microbiology Distinguished Lecturer
- 2008-present Member, Faculty of 1000
- 2005-2010 National Science Foundation Early Career Development (CAREER) Award
- 2002 American Cancer Society, Research Scholar Award (Declined for NIH RO1)
- 1999-2000 MIT/Merck Postdoctoral Fellow, Department of Biology, MIT
- 1996-1999 Marion Abbe Fellow, Damon Runyon Cancer Research Foundation
- 1992-1993 Paul Mazur Fellow, Harvard University, Department of Molecular & Cellular Biology
- 1989 *Cum Laude*, Williams College
- 1988-1989 Class of 1960 Scholar, Williams College, Department of Biology

Professional Service

Scientific Review and Service

- 2018-present Editorial Board Member, *Current Biology*
- 2016-present Front Matter Editor, *PLOS Genetics*
- 2016-present Member, NIH Prokaryotic Cell and Molecular Biology (PCMB) Study Section
- 2014-present Co-Chair elect, 2018 Microbial Stress Response Gordon Conference
- 2014-present Member, ASM Conferences Committee
- 2014-2015 Ad Hoc Member, NIH Prokaryotic Cell and Molecular Biology (PCMB) study section
- 2014-present Member, ASM Conferences Committee
- 2013 Member, Special Emphasis Panel, NIAID Centers of Excellence in Translational Research
- 2012-present Member, Editorial Board, *Journal of Bacteriology*
- 2010-2012 Organizer, Molecular Genetics of Bacteria and Phages Annual Meeting

Professional Service continued

2008-present	Member, Faculty of 1000
2008-present	Member, Editorial Advisory Board, <i>Molecular Microbiology</i>
2005-2006	Member, ACS Molecular Cell Biology of Cancer panel
2003-2005	Member, NSF Microbial Genetics review panel
2002-2013	Ad Hoc Reviewer, NSF multiple panels

Washington University Committees

2013-present	Co-Director Plant and Microbial Biosciences Graduate Program
2012-present	Member, Medical Scientist Training Program Admissions Committee
2015	Member, Mr. & Mrs. Spencer T. Olin Fellowship for Women review committee
2012-2013	Chair, Biology Department Prokaryotic Biology faculty search committee
2012	Member, Spector Prize Committee
2010	Member, Biology Department ICARES faculty search committee
2010-2013	Member, Faculty Senate Council
2009-2010	Member, Writing 1 Review Committee
2008	Member, Advisory Committee on Appointment Dean of Faculty of Arts & Sciences
2007, 2011-12	Member, Stalker Award Committee
2005	Member, Plant Biology faculty search committee
2006	Panelist, Pre-health Day
2005-2014	Member, Molecular Microbiology and Molecular Pathogenesis Graduate Program steering committee
2005, 2007	Member, HHMI SURF review Committee
2005-2007	Member, Biology Department Exit Interview Committee
2005	Member, Biology Department Academic Planning Committee
2007	Panelist, Liberal Arts Day
2002-2009	Member, Ph.D. Admissions committee, Division of Biology and Biomedical Sciences
2002-2004	Member, Moog Scholarship Review Committee, College of Arts and Sciences
2001-2002	Member, Molecular Geobiology faculty search committee, Department of Earth and Planetary Sciences, Washington University

Journal Reviewer

Average of 20 reviews per year for various journals including: *Molecular Microbiology*, *Journal of Bacteriology*, *Applied and Environmental Microbiology*, *EMBO*, *eLife*, *PNAS*, *Genes and Development*, *FEMS Letters*, *Cell*, *Molecular Cell*, *Developmental Cell*, *Microbiology*, *PLOS Biology*, *PLOS Genetics*, *PLOS One*, *Science*, *Journal of Biological Chemistry*, *Biochemistry*, *Biophysical Journal*

Teaching Experience**Washington University, Course Master/Co-course master**

2016-present	Infectious Diseases: History, Pathology, and Prevention (BIO 4492)
2014-present	Experimental Design and Analysis (BIO 5073)
2002-2015	Microbiology (BIO 349)
2001-present	Undergraduate independent study mentor (BIO 200 and BIO 500)

Washington University, Faculty advisor/Guest lecturer

2011-present	Freshman Seminar in Biology (BIO 181)
2010	Ethics and Research Science (BIO 5011)
2006-present	Molecular Microbiology and Microbial Pathogenesis (BIO 5392)
2005-present	Microbiology Laboratory (BIO 3491)
2008-2011	Phage Hunters Freshman Seminar (BIO 192)
2002	Special Topics in Pathogenesis (BIO 5217)
2002	Advanced Genetics (BIO 5491)
2001-2012	Molecular Cell Biology (BIO 5068)

Publications

1. Westfall, C. S. and P. A. Levin (**PREPRINT**) High levels of antibiotic tolerance and persistence are induced by the commercial anti-microbial triclosan, in revision. <http://www.biorxiv.org/content/early/2017/06/13/090829>
2. Hill, N. S., J. Zuke, P. J. Buske, A-C Chien, and P. A. Levin (2018) A nutrient-dependent division antagonist is regulated post-translationally by the Clp proteases in *Bacillus subtilis*, *BMC Microbiol* 18:29-43. PMID: 29625553 doi.org/10.1186/s12866-018-1155-2
3. Wehrens, M., D. Ershov, R. Rozendaal, N. Walker, D. Schultz, R. Kishony, P. A. Levin, and S. J. Tans (2018) Size Laws and Division Ring Dynamics in Filamentous *Escherichia coli* cells, *Curr Biol* 28: 1-8. PMID: 29502951 doi.org/10.1016/j.cub.2018.02.006
4. + Westfall, C. S. and P. A. Levin (2018) Comprehensive analysis of central carbon metabolism reveals multiple connections between nutrients, biosynthetic capacity, and cell morphology in *Escherichia coli*, *PLOS Genetics*, 14(2) e1007205. doi.org/10.1371/journal.pgen.1007205
5. Westfall, C.S. and P. A. Levin (2017) Bacterial Cell Size: Multifactorial and Multifaceted, *Invited review for Annual Review of Microbiology*, 71: 499-517. PMID: 28886685 DOI: 10.1146/annurev-micro-090816-093803
6. ****Vadia, S., J. L. Tse, Z. ‡Yang, R. Lucena, D. Kellogg, J. Wang, and P. A. Levin (2017) Fatty acid synthesis sets cell envelope capacity and dictates microbial cell size, *Curr Biol* 27:R1757-1767. PMID: 28602657 DOI: <http://dx.doi.org/10.1016/j.cub.2017.05.076>
7. Vadia, S. and P. A. Levin (2017) Bacterial Size: Can't escape the long arm of the law. *Curr Biol* 27:R339-R341. PMID:28486115 DOI:10.1016/j.cub.2017.03.050.
8. den Blaauwen, T., L. W. Hamoen, and P. A. Levin (2017) The Divisome at 25: The road ahead, *Curr Opin Microbiol* 36:85–94 PMID: 28254403 DOI:10.1016/j.mib.2017.01.001
9. Arjes, H.A., B. Lai, ‡E. R. Emelue, A. Steinbach, and P. A. Levin (2015) Mutations in the bacterial cell division protein FtsZ highlight the role of GTP binding and longitudinal subunit interactions in assembly and function. *BMC Microbiology*, 5:209 DOI 10.1186/s12866-015-0544-z.
10. Land, A.D., P. Hogan, S. Fritz and P. A. Levin (2015) Phenotypic variation is almost entirely independent of the host-pathogen relationship in clinical isolates of *S. aureus*, *PLoS ONE*, 10(6):e0129670. doi: 10.1371/journal.pone.0129670. PMID: 26098551.
11. Levin, P. A. and E. R. Angert, Small but mighty: cell size and bacteria (2015) Cold Spring Harbor Perspectives in Biology: Size Control in Biology, from Organelles to Organisms. Edited by Drs. Rebecca Heald, Iswar Hariharan, and David Wake 7(7):a019216. doi: 10.1101/cshperspect.a019216. PMID:26054743. *Invited book chapter*.
12. Vadia, S. and P. A. Levin, (2015) Growth rate and cell size: a re-examination of the growth law, *Curr Opin Microbiol*, 24:96-103. PMID: 25662920.
13. Taheri-Araghi, S, S. Bradde, J. T. Sauls, N. S. Hill, P. A. Levin, J. Paulsson, M. Vergassola, and S. Jun, Cell-size control and homeostasis in bacteria, (2015) *Curr Biol*, 25 (3), 385-391. PMID: 25544609
14. Buske, P. J., A. Mittal, R. V. Pappu and P. A. Levin (2014) An intrinsically disordered linker plays a critical role in bacterial cell division, *Sem Cell Dev Biol*, 37C:3-10. PMID: 25305578. *Invited Review*.
15. +* Arjes, H.A., A. Kriel, N.A. Sorto, J.T. Shaw, J. D. Wang and P. A. Levin, (2014) Failsafe mechanisms couple division and DNA replication in bacteria, *Curr Biol*, 24 (18): 2149–2155. [.doi.org/10.1016/j.cub.2014.07.055](https://doi.org/10.1016/j.cub.2014.07.055) PMID: 26463348
16. Land, A. D. Q. Luo, and P. A. Levin, (2014) Functional domain analysis of the cell division inhibitor EzrA, *PLoS ONE* 9(7): e102616. doi:10.1371/journal.pone.0102616. PMID: 25068683

17. + Hill, N. S., P. J. Buske, ‡Y. Shi, and P. A. Levin, (2013) A moonlighting enzyme links *Escherichia coli* cell size with central metabolism, *PLoS Genet.* 9(7): e1003663. doi:10.1371/journal.pgen.1003663. PMID: 23935518.
18. Buske, P. J. and P. A. Levin. (2013) A flexible C-terminal linker is required for proper FtsZ assembly *in vitro* and cytokinetic ring formation *in vivo*, *Mol Microbiol* 89:249-263. PMID: 23692518.
19. Chien, A-C, S. K. Zareh, Y. M. Wang and P. A. Levin. (2012) Changes in the oligomerization potential of the division inhibitor UgtP coordinate *Bacillus subtilis* cell size with nutrient availability, *Mol Microbiol* 86:594-610. PMID: 22931116.
20. Chien, A-C., N. S. Hill and P. A. Levin. (2012) Cell size control in bacteria, *Curr Biol*, 22(9):R340-9. PMID: 22575476. *Invited review*.
21. ** Hill, N. S., R. Kadoya, D. K. Chattoraj, and P. A. Levin. (2012) Cell size and the initiation of DNA replication in bacteria, *PLoS Genet* 8(3): e1002549. doi:10.1371/journal.pgen.1002549. PMID: 22396664
22. Buske, P. J. and P. A. Levin. (2012) The extreme C-terminus of the bacterial cytoskeletal protein FtsZ plays a fundamental role in assembly independent of modulatory proteins, *J Biol Chem*, 287:10945-10957. PMID: 22298780.
23. Wang, J. D. and P. A. Levin. (2009) Metabolism, cell growth, and the bacterial cell cycle, *Nat Rev Microbiol*, 7: 822-827. PMID: 19806155.
24. Haeusser, D. P., A. H. Lee, R. B., Weart and P. A. Levin. (2009) ClpX inhibits FtsZ assembly in a manner that does not require its ATP hydrolysis-dependent chaperone activity, *J Bacteriol*, 191:1986-1991. PMID: 19136590.
25. Haeusser, D. P. and P. A. Levin. (2008) The Great Divide: Coordinating cell cycle events during bacterial growth and division, *Curr Opin Microbiol*, 11:94–99. PMID: 18396093. *Invited review*.
26. Haeusser, D. P., ‡A. C. Garza, A. Buscher, and P. A. Levin. (2007) The division inhibitor EzrA contains a seven-residue patch required for maintaining the dynamic nature of the medial FtsZ ring, *J Bacteriol*, 189: 9001-9010. (Cover image). PMID: 17873055
27. Norris V., T. den Blaauwen, R. H. Doi, J. Errington, R. Harshey, L. Janniere, A. Jimenez-Sanchez, D. J. Jin, P. A. Levin, E. Mileykovskaya, A. Minsky, G. Misevic, C. Ripoll, M. Saier Jr, K Skarstad, and M. Thellier, (2007) Toward a hyperstructure taxonomy, *Annu Rev Micro*, 61:309-329. PMID: 17896876.
28. +*** Weart, R. B., A. H. Lee, A-C Chien, D. P. Haeusser, N. S. Hill and P. A. Levin. (2007) A metabolic sensor governing cell size in bacteria, *Cell*, 130:335-347. (Cover image) PMID: 17662947.
29. Norris, V., T. den Blaauwen, A. Cabin-Flaman, R. H. Doi, R. Harshey, L. Janniere, A. Jimenez-Sanchez, D. J. Jin, P. A. Levin, P. A., E. Mileykovskaya, A. Minsky, M. Saier Jr, and K. Skarstad, (2007) A functional taxonomy of bacterial hyperstructures, *Microbiol Mol Biol Rev*, 71(1):230-253. PMID: 17347523.
30. Weart, R. B., S. Nakano, B. E. Lane, P. Zuber, and P. A. Levin. (2005) The ClpX chaperone modulates assembly of the tubulin-like protein FtsZ, *Mol Microbiol*, 57:238-249. PMID: 15948963.
31. Haeusser, D.P., R. L. Schwartz, A. M. Smith, ‡M. E. Oates, and P. A. Levin. (2004) EzrA prevents aberrant cell division by modulating assembly of the cytoskeletal protein FtsZ, *Mol Microbiol* 52:801-814. PMID: 15101985.
32. Romberg, L. and P. A. Levin. (2003) Dynamic FtsZ rings in cell division: poised at the edge of stability. *Annu Rev Microbiol* 57: 125-154. PMID: 14527275
33. Weart, R. B. and P.A. Levin. (2003) Growth rate dependent regulation of FtsZ ring formation in *Bacillus subtilis*, *J Bacteriol* 185: 2826-2834. PMID: 12700262.
34. Levin, P. A. (2002) Light microscopy techniques for bacterial cell biology. *In* Phillippe Sansonetti and Arturo Zychlinsky (Eds.) *Methods in Microbiology* 31: *Molecular Cellular Microbiology*, 115-132. Academic Press Ltd., London. *Invited book chapter*.

35. § Levin, P. A., R. L. Schwartz, and A. D. Grossman. (2001) Polymer stability plays an important role in the positional regulation of FtsZ, *J Bacteriol* 183: 5449-5452. PMID: 11514533.
36. Levin, P. A. and R. Losick. (2000) Asymmetric cell division in *Bacillus subtilis*. In Y. V. Brun and L. Shimkets (Eds.) *Prokaryotic Development*, 167-189. American Society for Microbiology Press, Washington, D. C. *Invited book chapter*.
37. Levin, P. A., I. G. Kurtser and A. D. Grossman. (1999) Identification and characterization of *ezrA*, a negative regulator of FtsZ ring formation in *Bacillus subtilis*, *Proc Natl Acad Sci USA*, 96: 9642-9647. PMID: 10449747.
38. Levin, P. A., J. J. Shim, and A. D. Grossman. (1998) Effect of *minCD* on FtsZ ring formation and polar septation in *Bacillus subtilis*. *J Bacteriol* 180: 6048-6051. PMID: 9811667.
39. Levin, P. A. and A. D. Grossman. (1998) Cell cycle and sporulation in *Bacillus subtilis*. *Curr Opin Microbiol* 1:630-635. PMID: 10066540. *Invited review*.
40. Levin, P. A. and A. D. Grossman. (1998) Cell Cycle: The bacterial approach to coordination. *Curr Biol* 8: R28-R31. PMID: 9427618.
41. Levin, P. A., R. Losick, P. Stragier, and F. Arigoni. (1997) Localization of the sporulation protein SpoIIIE in *Bacillus subtilis* is dependent upon the cell division protein FtsZ. *Mol Microbiol* 25: 839-846. PMID: 9364910.
42. Lin, D. C.-H., P. A. Levin, and A. D. Grossman. (1997) Bipolar localization of a chromosome partition protein in *Bacillus subtilis*. *Proc Natl Acad Sci USA* 94: 4721-4726. PMID: 9114058.
43. Jin, S., P. A. Levin, K. Matsuno, A. D. Grossman, and A. L. Sonenshein. (1997) Deletion of the *Bacillus subtilis* isocitrate dehydrogenase gene causes a block at stage I of sporulation. *J Bacteriol* 179: 4725-4732. PMID: 9244258.
44. Levin, P. A. and R. Losick. (1996) Transcription factor Spo0A switches the localization of the cell division protein FtsZ from a medial to a bipolar pattern in *Bacillus subtilis*. *Genes Dev* 10: 478-488. PMID: 8600030.
45. Levin, P. A. and R. Losick. (1995) Generating specialized cell types by asymmetric division in *Bacillus subtilis*. *Sem Dev Biol* 6: 335-345. *Invited review*.
46. Levin, P. A. and R. Losick. (1994) Characterization of a cell division gene from *Bacillus subtilis* that is required for vegetative and sporulation septum formation. *J Bacteriol* 176: 1451-1459. PMID: 8113187.
47. Levin, P. A., N. Fan, E. Ricca, A. Driks, R. Losick and S. Cutting. (1993) An unusually small gene required for sporulation by *Bacillus subtilis*. *Mol Microbiol* 9: 761-771. PMID: 8231808.
48. Levin, P. A., P. S. Margolis, P. Setlow, R. Losick, and D. Sun. (1992) Identification of *Bacillus subtilis* genes for septum placement and shape determination. *J Bacteriol* 174: 6717-6728. PMID: 1400224.

+F1000 Recommended

* Subject of Current Biology Dispatch: Cell Cycle: Once Out, Never In Again, *Curr Biol* 24(18):R841–R843 (September 2014).

** Subject of Research Highlight in Nature Reviews Microbiology: Cellular microbiology: Replication comes in all sizes, *Nat Rev Microbiol* 10:312-313 (May 2012).

*** Subject of Cell Leading Edge Preview: A sweet sensor for size-conscious bacteria, *Cell* 130:216-218 (July 2007).

‡ Washington University undergraduate

§ Funded by an ACS-IRG award to Petra Levin, the corresponding author.

Invited Presentations Since 2010 (Italics indicates upcoming)

- September 2018 *EMBO conference on size and shape, Bangalore, India*
- May, 2018 Department of Microbial Pathogenesis, Yale University, New Haven, CT
- May, 2018 Weill Family Foundation Global Health Research Laboratories, 2018 Symposium on Microbial Systems Biology, Cornell Medical College, New York, NY
- April, 2018 Department of Biology, Texas A & M, College Station TX
- February 2018 Department of Microbiology and Molecular Genetics, University of Texas Health Sciences Center, Houston TX
- September, 2017 Great Wall Meeting, Sao Rafael, Portugal
- May, 2017 Department of Cell Biology and Molecular Genetics, University of Maryland, College Park, MD
- April, 2017 Department of Microbiology, University of Massachusetts, Amherst, MA
- March 2017 Department of Biochemistry and Molecular Biophysics, Washington University School of Medicine, St. Louis, MO
- September, 2016 Size and Scale in Biological Systems, Berlin, Germany
- June, 2016 Groningen Institute of Biomolecular Sciences & Biotechnology, University of Groningen, Netherlands
- May, 2016 AMBER Symposium: Central Carbon Metabolism and its Effect on Bacterial Processes, Paris, France
- March 2016 Centro Nacional de Biotecnologia, Madrid, Spain
- March, 2016 Biological Size Control: from organisms to organelles, UC Berkeley, Berkeley, xCA
- March, 2016 Molecular Biotechnology, Leiden University, Leiden, Netherlands
- November, 2015 Frontiers in Quantitative Biology Seminar Series, Stanford University, Palo Alto, CA
- June, 2015 Prokaryotic Cell and Developmental Biology Meeting, Washington, DC
- April, 2015 Basic Biomedical Sciences Department, University of South Dakota, Vermillion, SD
- March, 2015 Microbial Science Initiative, Harvard University, Cambridge, MA
- March, 2015 Graduate Student Invited Speaker, Biochemistry & Biophysics, UCSF, San Francisco, CA
- February, 2015 Biophysical Society Intrinsically Disordered Proteins Subgroup Symposium, Baltimore, MD
- October, 2014 Exciting Biologies 2014, The Biology of Size, La Jolla, CA
- October, 2014 Duke Center for Systems Biology Symposium, Durham, NC
- August, 2014 Gordon Research Conference on the Plant and Microbial Cytoskeleton, Andover, NH
- July, 2014 Gordon Research Conference on Microbial Stress Response, South Hadley, MA
- May, 2014 Honorary Division J Lecture, ASM General Meeting, Boston, MA
- May, 2014 50 years of Fts: the A-Z of bacterial cell division, Royal Netherlands Academy of Sciences Amsterdam, Netherlands
- March 2014 Plenary Speaker, ASM-Intermountain Branch Meeting, Provo, UT
- March, 2014 Bionanoscience Department, Delft University of Technology, Delft, Netherlands
- February, 2014 ASM Distinguished Lecturer - Rio Grande Branch Meeting, El Paso, TX
- December, 2013 Zing Conference on Bacterial Cell Biology, Xcaret, Mexico
- July, 2013 Gordon Research Conference on Microbial Adhesion & Signal Transduction, Newport, RI
- November, 2012 Department of Microbiology, University of Illinois, Urbana, IL
- September, 2012 EMBO Workshop: Reconstructing the essential bacterial cell cycle machinery, Real Sitio de San Ildefonso (Segovia), Spain
- July, 2012 Gordon Research Conference on Bacterial Cell Surfaces, West Dover, VT
- July, 2010 Gordon Research Conference on Microbial Stress Response, South Hadley, MA
- June 2010 Invited speaker, NSF workshop on Innovations in Biological Research and Education in the Molecular and Cellular Biosciences, Arlington, VA (June 2010)