

Curriculum Vitae

Michael D. Manson

Professor of Biology and of Biochemistry & Biophysics

Education:

1976, Ph.D., Biology, Stanford University

1969, B.A., Biology, Johns Hopkins University

Professional Experience:

1996-present, Professor, Department of Biology, Texas A&M University

1987-1996, Associate Professor, Department of Biology, Texas A&M University

1981-1986, Assistant Research Professor, Department of Biology, University of Konstanz (Germany)

1980-1981, Postdoctoral Fellow, Division of Biology, California Institute of Technology

1976-1979, Postdoctoral Fellow, Department of MCD Biology, University of Colorado

Professional Societies:

American Association for the Advancement of Science, 1987-present

American Society for Microbiology, 1987-present

Awards and Honors:

1969, Graduated with Honors in Biology from Johns Hopkins University

1965, Honorary Undergraduate Scholarship to Johns Hopkins University

Selected for Physiology Course at Woods Hole Marine Biological Institute, Summer 1969.

Awarded NSF Predoctoral Fellowship, 1969. (award declined)

NIH Traineeship in Molecular Biology, 1969-1973

NIH Postdoctoral Fellowship, 1975-1977

Invited Instructor, EMBO Practical Laboratory Course on Bacterial Taxia, March 11-24, 1984.

Member Editorial Board, Journal of Bacteriology (January 2005-present)

Member Editorial Board, Molecular Microbiology (January 2010-present)

Service:

Current

College of Science – Faculty Diversity Committee

Past

Biology - Editorial Board of *BioSphere*, the Biology Department Alumni Newsletter

Biology - Graduate Recruiting and Admissions Committee (until 11/2003)

Biology - Executive Committee (2003)

Biology - Senior Faculty Search Committee (2003)

Biology - Doctoral Program Review Committee (2000-2001)

Biology - Seminar Committee

Biology - Undergraduate Program Committee

College of Science - Faculty Advisory Council

Texas A&M University - Executive Committee of the Genetics Faculty

Texas A&M University - Life Sciences Task Force

Texas A&M University - Faculty Senate (including service on the Planning Committee)

Texas A&M University – Faculty Minigrant Selection Committee

Funded Research:

Sole principal investigator on ROI NIH Grant GM 39376 "Chemoreception and Signal Amplification in Bacteria". Total award 4/01/88 to 3/31/93: \$864,929. Total award 4/01/93 to 3/31/97: \$864,796. Total award 12/1/97 to 11/30/01: \$966,788. Sole P.I. on NIH proposal GM 39376-14 "Chemoreception and Signal Amplification in Bacteria". Total award (3/1/02 to 2/28/06) \$1,210,895 (direct \$200,000).

Sole principal investigator on ARO Grant DAAG55-97-1-0380 "Coupling Proton Conduction to Rotation in the Bacterial Flagellar Motor." Total award 4/1/93 to 11/30/97: \$237,923. Total award 9/01/97 to 8/31/00: \$240,000. No cost extension 9/1/00 to 8/31/01.

Co-PI on Life Sciences Task Force Grant "Program in Membrane Structure and Function," \$45,000 annually for two years (6/15/03 – 6/14/05). Total award \$90,000.

Co-PI on Life Sciences Task Force Grant "Evolution of Enzyme Specificity," \$37,500 for one year (9/1/03 – 8/31/04). Total award \$37,500.

Courses Taught:

Stanford University

Molecular Biology Laboratory, Teaching Assistant, 1969, 1974 (3 quarters)

Readings in Biology, Acting Instructor, 1974 (1 quarter)

University of Konstanz (Germany)

Introductory Microbiology, Laboratory Coordinator, 1981-1986

Diploma and Doctoral Student Research, Project Advisor, 1982-1986

Texas A&M University

Animal Behavior (undergraduate seminar), 2001-2005 (5 semesters)

Bacterial Genetics (undergraduate) 1990-1992, 2002-2009 (13 semesters)

Bacterial Physiology (undergraduate) 1988-2010 (26 semesters)

Biology Colloquium (undergraduate seminar), 1988-2000 (16 semesters)

Darwin and the Art of War (freshman seminar), 2002-2005 (4 semesters)

Fundamentals of Microbiology (undergraduate), 2001, 2006-2009 (5 semesters), plus occasional guest lectures.

Great Diseases of the World (Series of 5 or 6 guest lectures in Biomedical Sciences course offered by Prof. Ian Tizard – Spring 2000 and 2001.

Introductory Biology (BIOL111) 2006-2009 (4 semesters)

Introductory Biology (BIOL112) 2007-2010 (4 semesters)

Membrane Biology (graduate journal club) 1999-2006 (9 semesters, co-taught with Arthur Johnson and Ryland Young)

Microbial Development (graduate) 1999-2000 (co-taught with Jim Golden and Deborah Bell-Pedersen)

Microbiology Journal Club (undergraduate seminar) 1989-1991 (3 semesters)

Proposal Writing (graduate seminar), 2003 (1 semester)

Signal Transduction in Microorganisms (graduate seminar) 1987-1988 (three-week module)

Graduate Students Advised:

Committee Chair

Walid Abouhamad (Ph.D. 1994)
Yousin Suh (transferred to University of Houston in 1990, Ph.D. 1994)
Paul Gardina (Ph.D. 1995)
Anthony Garza (Ph.D. 1995)
Siromi Weerasuriya (Ph.D. 1998)
Scott Ward (Ph.D., 2005)
Arjan Bormans (Ph.D. 2005)
Brian Cantwell (Ph.D. 2006)
Edan Hosking (Ph.D. 2007)
Roger Draheim (Ph.D. 2007)
Run-Zhi Lai (Ph.D. 2007)
Gus Wright (Ph.D. 2009)
Chris Adase (Ph.D. candidate. Matriculated Fall of 2005)
Andrew Seely (Ph.D. candidate. Matriculated Fall of 2007)
Gregory Whitaker (Ph.D. candidate. Matriculated Fall of 2009)
Sneha Jani (Ph.D. candidate. Matriculated Fall of 2009)

Co-Chair (with Karin Ippen-Ihler, who was primary research advisor)
Sumit Maneewannakul (Ph.D. awarded 1990)
Nadim Majdalani (Ph.D. awarded 1995)

Publications:

Peer-reviewed research articles

- 49) Hegde, M., Englert, D.L., Shrock, S., Cohn, W.B., Vogt, C., Wood, T.K., **Manson, M.D.**, and Jayaraman, A. (2010) Chemotaxis to the quorum-sensing signal AI-2 requires the Tsr chemoreceptor and the periplasmic AI-2 binding protein. *J. Bacteriol.* (Epub ahead of print)
- 48) Wright, G.A., Crowder, R.L., Draheim, R.R., and **Manson, M.D.** (2010) Mutational analysis of the TM2-HAMP connection in Tar_{EC}, the *E. coli* aspartate chemoreceptor. *J. Bacteriol.* (Epub ahead of print)
- 47) Englert, D.L., **Manson, M.D.**, and Jayaraman, A. (2010) Investigation of bacterial chemotaxis in flow-based microfluidic devices. *Nat. Protoc.* **5**: 864-872.
- 46) Englert, D.L., Adase, C.A., Jayaraman, A., and **Manson, M.D.** (2010) Repellent taxis to nickel ion requires neither Ni²⁺ transport nor the periplasmic NikA binding protein. *J. Bacteriol.* **192**: 2633-2367.
- 45) Englert, D.L., Jayaraman, A., **Manson, M.D.** (2009) Microfluidic techniques for the analysis of bacterial chemotaxis. *Methods Mol. Biol.* **573**: 1-21.
- 44) Cantwell, B.J., and **Manson, M.D.** (2009) Protein domains and residues involved in the CheZ/CheAshort interaction. *J. Bacteriol.* **191**:5838-5841.
- 43) Englert, D.L., **Manson, M.D.**, and Jayaraman, A. (2009) Flow-based microfluidic device for quantifying bacterial chemotaxis in stable, competing gradients. *Appl. Environ. Microbiol.* **75**:4557-4561.
- 42) Hosking, E.R., and **Manson, M.D.** (2008) Clusters of charged residues at the C-terminus of MotA and N-terminus of MotB are important for function of the *E. coli* flagellar motor. *J. Bacteriol.* **190**: 5517-5521.

- 41) Lai, R.-Z., Bormans, A.F., Draheim, R.R., Wright, G.A. and **Manson, M.D.** (2008) The region preceding the C-terminal NWETF pentapeptide modulates baseline activity and aspartate inhibition of *Escherichia coli* Tar. *Biochemistry* **47**: 13287-13295.
- 40) Hosking, E.R., Vogt, C., and **Manson, M.D.** (2006) The MotAB proton channel unplugged. *J. Mol. Biol.* **364**: 921-937.
- 39) Draheim, R.R., Bormans, A.F., Lai, R.-Z., and **Manson, M.D.** (2006) Tuning a bacterial chemoreceptor with protein-membrane interactions. *Biochemistry* **45**: 14655-14664.
- 38) Ward, S. M., Bormans, A.F., and **Manson, M.D.** (2006) Mutationally reversed signal output in the Nart (NarX-Tar) hybrid chemoreceptor. *J. Bacteriol.* **188**: 3944-3951.
- 37) Lai, R.-Z., Manson, J.M.B., Bormans, A.F., Draheim, R.R., Nguyen, N.T., and **Manson, M.D.** (2005) Cooperative signaling among bacterial chemoreceptors. *Biochemistry* **44**: 14298-14307.
- 36) Draheim, R.R., Bormans, A.F., Lai, R.-Z., and **Manson, M.D.** (2005) Tryptophan residues flanking the second transmembrane helix (TM2) set the signaling state of the Tar chemoreceptor. *Biochemistry* **44**: 1268-1277.
- 35) Van Way, S.M., Millas, S.G., Lee, A.H., and **Manson, M.D.** (2004) Rusty, jammed and well-oiled hinges: Mutations affecting the interdomain region of FliG, a rotor element of the *E. coli* flagellar motor. *J. Bacteriol.* **186**: 3173-3181.
- 34) Mao, H., Cremer, P.S., and **Manson, M.D.** (2003) A sensitive, versatile microfluidic assay for bacterial chemotaxis. *Proc. Natl. Acad. Sci. USA* **100**: 5449-5454.
- 33) Cantwell, B.J., Draheim, R.R., Weart, R.B., Nguyen, C., and **Manson, M.D.** (2003) CheZ phosphatase localizes to chemoreceptor patches via CheA-short. *J. Bacteriol.* **285**: 2354-2361.
- 32) Ward, S.M., Delgado, A., Gunsalus, R.P., and **Manson, M.D.** (2002) A NarX-Tar chimera mediates repellent chemotaxis to nitrate and nitrite. *Mol. Microbiol.* **44**: 709-719.
- 31) Gründling, A., **Manson, M.D.**, and Young, R. (2001) Holins kill without warning. *Proc. Natl. Acad. Sci. USA* **98**: 9348-9352.
- 30) Van Way, S.M., Hosking, E.R., Braun, T.F., and **Manson, M.D.** (2000) Mot protein assembly into the bacterial flagellum: A model based on mutational analysis of the *motB* gene. *J. Mol. Biol.* **297**: 7-24.
- 29) Zhang, Y., Gardina, P.J., Kuebler, A.S., Kang, H.S., Christopher, J.A., and **Manson, M.D.** (1999) Model of maltose-binding protein/chemoreceptor complex supports intrasubunit signaling mechanism. *Proc. Natl. Acad. Sci. USA* **96**: 939-944.
- 28) Gardina, P.J., Bormans, A.F., and **Manson, M.D.** (1998) A mechanism for simultaneous sensing of aspartate and maltose by the Tar chemoreceptor of *Escherichia coli*. *Mol. Microbiol.* **29**: 1147-1154.
- 27) Weerasuriya, S.N., Schneider, B.M., and **Manson, M.D.** (1998) Chimeric chemoreceptors in *Escherichia coli*: Signaling and methylation properties of Tar-Tap and Tap-Tar hybrids. *J. Bacteriol.* **180**: 914-920.
- 26) Gardina, P.J., Bormans, A.F., Hawkins, M.A., Meeker, J.W., and **Manson, M.D.** (1997) Maltose-binding protein interacts simultaneously and asymmetrically with both subunits of the Tar chemoreceptor. *Mol. Microbiol.* **23**: 1181-1191.
- 25) Garza, A.G., Bronstein, P.A., Valdez, P.A. Harris-Haller, L.W., and **Manson, M.D.** (1996) Extragenic suppression of *motA* missense mutations in *Escherichia coli*. *J. Bacteriol.* **178**: 6116-6122.
- 24) Gardina, P.J., and **Manson, M.D.** (1996) Attractant signaling by an aspartate chemoreceptor dimer with a single cytoplasmic domain. *Science* **274**: 425-426.
- 23) Zhang, Y., Mannering, D.E., Davidson, A.L., Yao, N., and **Manson, M.D.** (1996) Maltose-binding protein containing an interdomain disulfide bridge confers a dominant-negative phenotype for chemotaxis and transport. *J. Biol. Chem.* **271**: 17881-17889.

- 22) Garza, A.G., Biran, R., Wohlschlegel, J.A., and **Manson, M.D.** (1996) Motor defects suppressed by mutations affecting stator or rotor components of bacterial flagella. *J. Mol. Biol.* **258**: 270-285.
- 21) Garza, A.G., Harris-Haller, L.W., Stoebner, R.A., and **Manson, M.D.** (1995) Motility protein interactions in the bacterial flagellar motor. *Proc. Natl. Acad. Sci. USA.* **92**: 1970-1975.
- 20) Abouhamad, W.N., and **Manson, M.D.** (1994) The dipeptide permease of *Escherichia coli* closely resembles other bacterial transport systems and shows growth-phase-dependent expression. *Mol. Microbiol.* **14**: 1077-1092.
- 19) Zhang, Y., Conway, C., Rosato, M., Suh, Y., and **Manson, M.D.** (1992) Maltose chemotaxis involves residues in the N-terminal and C-terminal domains on the same face of maltose-binding protein. *J. Biol. Chem.* **267**: 22813-22820.
- 18) Gardina, P., Conway, C., Kossmann, M., and **Manson, M.D.** (1992) Aspartate and maltose-binding protein interact with adjacent sites in the Tar chemotactic signal transducer of *Escherichia coli*. *J. Bacteriol.* **174**: 1528-1536.
- 17) Abouhamad, W.N., **Manson M.D.**, Gibson M.M., and Higgins, C.F. (1991) Peptide transport and chemotaxis in *Escherichia coli* and *Salmonella typhimurium*: Characterization of the dipeptide permease and the dipeptide binding protein. *Mol. Microbiol.* **5**: 1035-1047.
- 16) Dahl, M.K., Francocz, E., Saurin, W., Boos, W., Hofnung, M., and **Manson, M.D.** (1989) DNA sequences from the *malB* regions of *Salmonella typhimurium* and *Enterobacter aerogenes*: Comparison with *Escherichia coli*. *Mol. Gen. Genet.* **218**: 199-207.
- 15) Dahl, M.K., Boos, W., and **Manson, M.D.** (1989) Evolution of chemotactic signal transducers in the enteric bacteria. *J. Bacteriol.* **171**: 2361-2371.
- 14) Gebert, J.F., Overhoff, B., **Manson, M.D.**, and Boos, W. (1988) The Tsr chemosensory transducer of *Escherichia coli* assembles into the cytoplasmic membrane via a *SecA*-dependent process. *J. Biol. Chem.* **263**: 16652-16660.
- 13) Kossmann, M., Wolff, C., and **Manson, M.D.** (1988) The maltose chemoreceptor of *Escherichia coli*: Interaction of maltose-binding protein and the Tar signal transducer. *J. Bacteriol.* **170**: 4516-4521.
- 12) Scholle, A., Vreemann, J., Blank, V., Nold, A., Boos, W., and **Manson, M.D.** (1987) Sequence of the *mgIB* gene from *Escherichia coli* K-12: Comparison of wild-type and mutant galactose chemoreceptors. *Mol. Gen. Genet.* **208**: 254-262.
- 11) **Manson, M.D.**, Blank, V., Brade, G., and Higgins, C. F. (1986) Peptide chemotaxis in *E. coli* involves the Tap signal transducer and the dipeptide permease. *Nature* **321**: 253-256.
- 10) **Manson, M.D.**, and Kossmann, M. (1986) Mutations in *tar* suppress defects in maltose chemotaxis caused by specific *malE* mutations. *J. Bacteriol.* **165**: 34-40.
- 9) Dahl, M.K., and **Manson, M.D.** (1985) Interspecific reconstitution of maltose transport and chemotaxis with maltose-binding protein from various enteric bacteria. *J. Bacteriol.* **164**: 1057-1063.
- 8) **Manson, M.D.**, Boos, W., Bassford Jr., P.J., and Rasmussen, B.A. (1985) Dependence of maltose transport and chemotaxis on the amount of maltose-binding protein. *J. Biol. Chem.* **260**: 9727-9732.
- 7) Brass, J.M., **Manson, M.D.**, and Larson, T.J. (1984) Transposon Tn10-dependent expression of the *lamB* gene in *Escherichia coli*. *J. Bacteriol.* **159**: 93-99.
- 6) Brass, J.M., and **Manson, M.D.** (1984) Reconstitution of maltose chemotaxis in *Escherichia coli* by addition of maltose-binding protein to calcium-treated cells of maltose regulon mutants. *J. Bacteriol.* **157**: 881-890.
- 5) Segall, J.E., **Manson, M.D.**, and Berg, H.C. (1982) Signal processing times in bacterial chemotaxis. *Nature* **296**: 855-857.
- 4) **Manson, M.D.**, Tedesco, P., and Berg, H.C. (1980) Energetics of flagellar rotation in bacteria. *J. Mol. Biol.* **138**: 541-561.

- 3) **Manson, M.D.**, Tedesco, P., Berg, H.C., Harold, F.M., and van der Drift, C. (1977) A protonmotive force drives bacterial flagella. *Proc. Natl. Acad. Sci. USA* **74**: 3060-3064.
- 2) **Manson, M.D.**, and Yanofsky, C. (1976) Tryptophan operon regulation in interspecific hybrids of enteric bacteria. *J. Bacteriol.* **126**: 679-689.
- 1) **Manson, M.D.**, and Yanofsky, C. (1976) Naturally occurring sites within the *Shigella dysenteriae* tryptophan operon severely limit tryptophan biosynthesis. *J. Bacteriol.* **126**: 668-678.

Proceedings papers:

- 5) Englert, D.L., **Manson, M.D.**, and Jayaraman, A. (2010) A microfluidic device for quantifying bacterial chemotaxis in stable concentration gradients. *J. Vis. Exp.* **38**: 1779.
- 4) McAndrew, R.S., Ellis, A.E., Lai, R.-Z., **Manson, M.**, and Holzenburg, A. (2006) Effects of chemoreceptor modification on the structures of Tsr arrays. *Microsc. Microanal.* **12** (Suppl. 2): 378-379.
- 3) McAndrew, R.S., Ellis, A.E., Lai, R.-Z., **Manson, M.**, and Holzenburg, A. (2005) Identification of Tsr and Tar chemoreceptor arrays in *E. coli* inner membranes. *Microsc. Microanal.* **11** (Suppl. 2): 1190-1191.
- 2) McAndrew, R.S., Ellis, A.E., **Manson, M.**, and Holzenburg, A. (2004) TEM analysis of chemoreceptor arrays of *E. coli* in native membranes. *Microsc. Microanal.* **10**: 416-417.
- 1) Young, J.J., Lee, C.-C., Malshe, A.P., Tung, S., and **Manson, M.D.** (2001) Design and fabrication of a cell-motor-driven microfluidic system. *Proc. ASME Intl. Mech. Engr. Cong. Expo.* ICMNS2001/MEMS-23869.

Ph.D. dissertation:

Manson, M.D. (1975) Studies on the evolution of the tryptophan synthetic pathway of the enteric bacteria. (Stanford University).

Book chapter:

- 1) **Manson, M.D.** (2010) Bacterial chemoreceptors as membrane-spanning allosteric enzymes. In Spiro, S., and Dixon, R., eds., *Sensory Mechanisms in Bacteria: Molecular Aspects of Signal Recognition*, Caister Academic Press, Norfolk, United Kingdom, pp. 107-149.

Review and commentary articles:

- 15) **Manson, M.D.** (2010) Dynamic motors for bacterial flagella. *Proc. Natl. Acad. Sci. USA* **107**: 11151-11152.
- 14) **Manson, M.D.** (2009) A mutational wrench in the HAMP gearbox. *Mol. Microbiol.* **73**:742-746.
- 13) **Manson, M.D.**, and Harlow, M.L. (2009) A grand view of the flagellar motor. *J. Bacteriol.* **191**: 5023-5025.
- 12) Englert, D.L., Jayaraman, A., **Manson, M.D.** (2009) Microfluidic techniques for the analysis of bacterial chemotaxis. *Methods Mol. Biol* **571**: 1-23.
- 11) **Manson, M.D.** (2008) The tie that binds the dynamic duo: the connector between AS1 and AS2 in the HAMP domain of the *Escherichia coli* Tsr chemoreceptor. *J. Bacteriol.* **190**: 6544-6547.
- 10) **Manson, M.D.** (2007) How 34 pegs fit into 26 + 8 holes in the flagellar motor. *J. Bacteriol.* **189**: 291-293.
- 9) **Manson, M.D.** (2002) Thanks, Charley. [A tribute to Charles Yanofsky.] *J. Bacteriol.* **184**: 2065-2071.
- 8) **Manson, M.D.**, and Cantwell, B.J. (2000) Model is as model does. *Nature Cell Biol.* **2**: E199-

201.

- 7) **Manson, M.D.** (2000) Allele-specific suppression as a tool to study protein-protein interactions in bacteria. *Methods* **20**: 18-34.
- 6) **Manson, M.D.**, Armitage, J.P., Hoch, J.A., and Macnab, R.M. (1998) Bacterial locomotion and sensory transduction. *J. Bacteriol.* **180**: 1009-1022.
- 5) **Manson, M.D.**, and Segall, J.E. (1992) "Chemotaxis", in *Encyclopedia of Microbiology*, vol. 1, (J. Lederberg, ed.), pp. 501-512, Academic Press, San Diego, CA.
- 4) **Manson, M.D.** (1992) Bacterial motility and chemotaxis. *Adv. Microb. Physiol.* **33**: 277-346.
- 3) **Manson, M.D.** (1990) Introduction to bacterial motility and chemotaxis. *J. Chem. Ecol.* **16**: 107-113.
- 2) Brass, J.M., Bukau, B., and **Manson, M.D.** (1984) Calcium-induced permeabilization of the outer membrane of *Escherichia coli*: A method for introducing biologically active molecules into the periplasmic space. *Microbiology* **17A**: 66-70.
- 1) Berg, H.C., **Manson, M.D.**, and Conley, P. (1982) Dynamics and energetics of flagellar rotation in bacteria. In *Prokaryotic and Eukaryotic Flagella*, W.B. Amos and J.G. Duckett (eds.) *Soc. Exp. Biol. Symp. XXXV*, Cambridge Univ. Press, Cambridge.