CURRICULUM VITAE

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Date of birth: August 21, 1954
Place of birth: Fairfax County, VA, USA

EMPLOYMENT

1999 - present	**Professor**	*Department of Biology* College of Arts and Sciences Case Western Reserve University
1999 - present	**Professor**	*Department of Neuroscience* School of Medicine Case Western Reserve University
1999 - present	**Professor**	*Department of Biomedical Engineering* Case School of Engineering Case Western Reserve University
1992 - 1999	**Associate Professor**	*Department of Neuroscience* Case Western Reserve University
1992 - 1999	**Associate Professor**	*Department of Biology* Case Western Reserve University
1989 - 1992	**Assistant Professor**	*Department of Neuroscience*, Case Western Reserve University
1987 - 1992	**Assistant Professor**	*Department of Biology*, Case Western Reserve University
1985 - 1987	**Consultant in Neurobiology**	*Department of Molecular Biophysics* AT&T Bell Laboratories Murray Hill, NJ 07974.
1980 - 1985	**Postdoctoral Fellow**	*Center for Neurobiology and Behavior* Columbia University's College of Physicians and Surgeons New York, NY 10032.

EDUCATION

1980	M.I.T.	Ph.D.	Neural and Endocrine Regulation
1976	M.I.T.	M.S.	Nutrition and Metabolism
1974	Yale University	B.A.	English

HONORS AND AWARDS

2009	Diekhoff Award for Excellence in Graduate Teaching
2004	Elected a Fellow of the Institute of Physics, London, England
2004	Wittke Award for Excellence in Undergraduate Teaching
2004	Undergraduate Teaching Excellence Award in Engineering
1998	Undergraduate Teaching Excellence Award in Mathematics and Natural Sciences
1997	Hewlett Award for an Innovative Teaching Initiative
1995	Best Video Award for video entitled "Biologically-Inspired Hexapod Robot Project: Second Robot", 1995 IEEE International Conference on Robotics and Automation
1991	Creativity Extension on NSF grant
1989 - 1992	George B. Mayer Assistant Professorship
1989	Sigma Xi Research Award for Faculty
1988	Award for Excellence, University Office of Undergraduate Affairs
1981	NIMH National Research Award
1980	Election to membership in Sigma Xi, M.I.T. Chapter
1972	Benjamin F. Barge Prize in Mathematics, Yale University

MEMBERSHIPS

Society for Neuroscience
International Society for Neuroethology
Mathematical Association of America
American Association for the Advancement of Science

RESEARCH GRANTS

Principal Investigator, **CRCNS: Robust Dynamics of a Feeding Pattern Generator**, NSF, 09/01/2010 – 08/31/2013, $500,000 (total).

Principal Investigator, **Neuromechanics of Multifunctionality in *Aplysia***, NIH, 02/14/05 – 02/13/09, $1,769,065 (total).

Co-Principal Investigator, **Diamond Neuro-Sensing and Neural Stimulating Electrodes**, NIH, 07/01/06 – 06/30/2010, $1,365,975 (total). Dr. Heidi Martin, Chemical Engineering, P.I.

Co-Principal Investigator, **Electrode Arrays for Neurodynamic Studies**, NSF, 09/01/07 – 08/31/10, $375,196 (total). Dr. Massood Tabib-Azar, EECS, P.I.

Principal Investgator, **Peristaltic Pneumatic Power-Assist Sleeve**, Olympus Corporation, 05/03/2005 – 05/02/2007, $43,806 (total).

Principal Investigator, **Collaborative Research in Computational Neuroscience (CRCNS): Dynamics and Plasticity of a Neuromechanical System**, NSF, 08/15/02 – 10/31/06, $800,000 (total).

Co-Principal Investigator, **Optical Control of a Rhodopsin-Based Switch**, Ohio Board of Regents, $75,580 (total).

Co-Principal Investigator, **Reconfigurable and Multifunctional Behavioral Pattern Generators**, NSF, 6/1/2002 - 5/31/2004, $399,035 (total). Dr. Randall Beer, EECS, P.I.

Principal Investigator, **Neuromechanics of a Muscular Hydrostatic Manipulator,** CWRU Presidential Research Initiative Grant, 1/01/2001 - 12/31/2002, $50,000 (total)

Principal Investigator, **Neural Control of a Context-Dependent Molluscan Feeding Muscle**, NSF, 9/15/1999- 9/14/2002, $371,431 (total).

Principal Investigator, **Neural Basis of Multifunctionality in the Feeding Behavior of *Aplysia***,

Whitehall Foundation, 7/1/1997 - 6/30/2000, $117,088 (direct), $2,912 (indirect), $120,000 (total).

Principal Investigator, **Dynamics of Biological Systems: A Proposal to Create a New Course**, UCITE, 7/1/2000 - 6/30/2001, $10,000.

Core Faculty, **Integrative Graduate Education and Research Training in Neuromechanical Systems**, NSF, 8/1/1999 - 7/31/2004, $2,629,105,Drs. Roy Ritzmann and Pat Crago, co-PIs.

Co-Prinicipal Investigator, **Autonomous Robotics Program**, Parker Hannifin, Dr. Randall Beer, P.I., 9/1/200- 8/31/200, $10,000.

Co-Principal Investigator, **Autonomous Robotics Course**, The Case Alumni Association, Dr. Randall Beer, P.I., 6/15/97 - 6/14/98, $27,300 (total).

Investigator, **Learning and Intelligent Systems: Agile Procedural Learning Systems**, NSF, Dr. Randall Beer, P.I., 9/1/1997 - 8/31/2000, $775,000 (total).

Co-Principal Investigator, **A Cockroach-Like Hexapod Robot for Natural Terrain Locomotion**, Office of Naval Research, Dr. Randall Beer, P.I., 1/1/1996 - 12/31/1998, $397,620 (direct), $202,380 (indirect), $600,000 (total).

Co-Principal Investigator, **Locomotion Controller for Walking Machines for Shallow Underwater Operations**, Subcontract from K^2T (Duquesne, PA) through SBIR from Office of Naval Research, 1995 - 97, $150,000.

Co-Principal Investigator, **Locomotion Controller for Walking Robots for Clearance of Improved Conventional Munitions**, Subcontract from K^2T (Duquesne, PA) through Office of Naval Research, 1995-98, $317,000.

Principal Investigator, **Neural Networks for Adaptive Behavior**, NSF Grant IBN-9309691. 8/15/1993 - 8/14/1995, $95,426 (direct), $48,667 (indirect), $144, 093 (total).

Principal Investigator, **Neural Network Control of Quasi-Rhythmic Behavior**, Project 1 of NIH Program Project Grant, Dr. Neil Cherniack, P.I. 4/1/91 - 3/31/96, $509,427 (direct), $224,512 (indirect), $733,939 (total for Project 1).

Co-Principal Investigator, **A Biologically-Inspired Autonomous Robot**, Office of Naval Research (3 year extension of grant N00014-90-J-1545), Dr. Randall Beer, P.I., 1/1/1993 - 12/31/1996, $429,880 (direct), $214,139 (indirect), $644,019 (total).

Co-Principal Investigator, **Undergraduate Biological Sciences Educational Initiative**, Howard Hughes Medical Institute, Dr. Norman B. Rushforth, P.I., 9/1/1994 - 8/31/1998, $2,000,000 (total).

Co-Principal Investigator, **Central Pattern Generators for *Aplysia* Feeding**, United States - Israel Binational Science Foundation, 93-00224, Dr. Abraham Susswein, P.I., 8/1/1994 - 7/31/1997, $100,500 (total).

Principal Investigator, **Pattern Generation in Neural Networks**, NSF Grant BNS88-10757. 8/1/1988-7/31/1993, $356,163 (direct), $144,211 (indirect), $500,374 (total).

Co-Principal Investigator, **Neural Networks for Real-Time Sensory Data Processing and Sensorimotor Control**, Office of Naval Research (N00014-90-J-1545), Dr. Randall Beer, P.I. 1990 - 1993, $250,564 (direct), $89,436 (indirect), $340,000 (total).

Co-principal Investigator, **Instrumentation for a Modern Undergraduate Neurobiology Laboratory**, NSF. 1990-1991, Dr. Roy Ritzmann, P.I., $74,788 (total).

Principal Investigator, **Neuronal Computation in Simpler Nervous Systems and Circuits**, Research Initiation Grant, Ohio Board of Regents, 1987-1988, $5000.

PATENTS

Neural-based Autonomous Robotic System, R. D. Beer, H. J. Chiel and L. S. Sterling; patent number 5,124,918, 6/23/1992.

Peristaltically Self-Propelled Endoscopic Device, H. J. Chiel, R. D. Quinn, R. D. Beer, and E. V. Mangan; patent number 6,764,441, 7/20/2004.

EDUCATIONAL EXPERIENCE

1988 - present (Fall)	Designed and taught course, **Introduction to Neurobiology** (BIOL 373/473; NEUR 473)
1988 (Spring)	Lecturer, **Associative Neural Networks for Computing** (EEAP 396/496)
1988 - 1991 (Fall)	Led Freshman Seminar, **How the Brain Works**
1989 - 1999 (Spring)	Designed and taught course, **Neurobiology Laboratory** (BIOL 376/476)
1990 - 2000 (Fall)	Lecturer, **Systems Neuroscience** (NEUR 406)
1990 - 2006 (Spring)	Designed and taught course, **Computational Neuroscience** (BIOL 378/478); taught in alternate years
1990 - 2000 (Spring)	Lecturer, **Cell and Molecular Neurobiology**, (NEUR 405)
1991 - 2006 (Spring)	Designed and taught course, **Seminar in Computational Neuroscience** (BIOL 379); taught in alternate years
1991 - 1993 (Fall)	Led Freshman Seminar, **Life's Designs**
1995 - 2006	Designed and taught course, **Autonomous Robotics** (BIOL 375, 475); taught in both Fall and Spring semesters
2000 - present	Designed and taught course, **Dynamics of Biological Systems** (BIOL 300/ EBME 300); currently taught in both Fall and Spring semesters.
2000 - 2004	Designed and taught course, **Dynamics of Adaptive Behavior** (BIOL 477/ ECES 477); taught in alternative years

SERVICE

1987 - 1991	Member, Curriculum Committee, Faculty of Mathematics and Natural Sciences
1989 - 2009	Member, Steering Committee for CWRU's grant from the Howard Hughes Medical Institute for its Undergraduate Biological Sciences Educational Initiative
1990 - 1991	Member, Curriculum Committee of the General Faculty of the Colleges
1990 - 2004	Science Consultant, Private Day School in University Heights (Bet Sefer Mizrachi); member of its Education Committee, Judge of Science Fair, responsible for special science presentations; Chairman of Science Committee; Education Vice-President 1997 - 1998; received Education Leadership Award in 1999; Chair of Head Support and Evaluation Committee, 2000 - 2004
1992 - 1993	Member, Search Advisory Committee to select Dean of College of Arts and Sciences
1992 - 1993	Member, Planning Committee for Renewal Grant to Howard Hughes Medical Institute Undergraduate Biological Sciences Educational Initiative
1994 - 2000	Co-chair, Curriculum Enhancement Committee
1996 - present	Panel for Hearing Procedures
1997 - 1998	Member, Provost's Search Committee for a BME faculty member in electrophysiology of neurons and neural networks
1999 - 2000	Member, President's Advisory Committee for Promotion and Tenure in the School of Dentistry
2000 - 2001	Member, Search committee for Neuromechanics faculty member in Department of Biology
2002 – 2003	Member, Search committee for Theoretical Biology faculty member in Department of Biology
2003	Member, Committee on the Future of Information Technology at CWRU

2004 – 2008	Member, Graduate Affairs Committee, Department of Biology
2004 – 2009	Member, Committee on Systems Biology Major
2006	Member, Bylaws Committee for Department of Biology

REFEREED PUBLICATIONS

Chiel, H. J., McManus, J. M. and Shaw, K. M. (2010) From biology to mathematical models and back: Teaching modeling to biology students, and biology to math and engineering students. CBE Life Sciences Education, 9:248-265.

Narasimhan, S., Chiel, H. J., and Bhunia, S. (in press) Ultra low-power and robust neural signal processing hardware for implantable microsystems. IEEE Transactions on Biomedical Circuits and Systems.

Halpern, J. M., Cullins, M. J., Chiel, H. J., and Martin, H. (2010) Chronic *in vivo* nerve electrical recordings of *Aplysia californica* using a boron-doped polycrystalline diamond electrode, Diamond and Related Materials, 19:178-181.

Cullins, M. J. and Chiel, H. J. (2010) Electrode fabrication and implantation in Aplysia californica for multi-channel neural and muscular recordings in intact, freely behaving animals. Journal of Visualized Experiments 40: 1791. doi:10.379/1791.

Jenkins, M.W., Duke, A. R., Gu, S., Doughman, Y., Chiel, H. J., Fujioka, H., Watanabe, M., Jansen, E. D., and Rollins, A. M. (2010) Optical pacing of the embryonic heart. Nature Photonics, 4:623-626, doi: 10.1038/nphoton.2010.166.

Azizi, F., Lu, H., Chiel, H. J., and Mastrangelo, C. H. (2010) Chemical neurostimulation using pulse code modulation (PCM) microfluidic chips. Journal of Neuroscience Methods 192:193-8.

Boxerbaum, A., Chiel, H. J., and Quinn, R. D. (2010) A new theory and methods of creating peristaltic motion in a robotic platform. IEEE International Conference on Robotics and Automation, May 4 - 8, 2010, Anchorage, Alaska, USA.

Limnuson, K., Lu, H., Chiel, H. J. and Mohseni, P. (2010) VLSI implementation of a template subtraction algorithm for real-time stimulus artifact rejection. IEEE Engineering and Biology and Medicine Conference 2010, Buenos Aires, Argentina, August 31 – September 4, 2010, pp. 2939 - 2942.

Chiel, H.J., Ting, L. H., Ekeberg, O., Hartmann, M.J.Z. (2009). The Brain in its Body: Motor Control and Sensing in a Biomechanical Context. Journal of Neuroscience 29:12807-12814.

Fang, D., Jiang, D., Lui, H., Chiel, H. J., Kelley, T. J., Burgess, J. D. (2009). Observation of cellular cholesterol efflux at microcavity electrodes. Journal of the American Chemical Society 131:12308-12309.

Narasimhan, S., Chiel, H., Bhunia, S. (2009). A preferential design approach for energy-efficient and robust implantable neural signal processing hardware. 31st Annual International IEEE EMBS Conference, 2009:6383-6.

Lu, H., Chestek, C. A., Shaw, K. M., and Chiel, H. J. (2008) Selective extracellular stimulation of individual neurons in ganglia. Journal of Neural Engineering. 5:287 - 309.

Roham, M., Halpern, J. M., Martin, H. M., Chiel, H. J. and Mohseni, P. (2008) Wireless amperometric neurochemical monitoring using an integrated telemetry circuit. IEEE Transactions on Biomedical Engineering. 55:2628 - 2634.

Beer, R. D. and Chiel, H. J. (2008) Computational Neuroethology. Scholarpedia 3(3):5307. [Scholarpedia is an online, peer-reviewed encyclopedia]

Azizi, F., Mastrangelo, C. H., Lu, H. and Chiel, H. J. (2008) Chemical stimulation of Aplysia californica ganglion with microfluidic signal generators. IEEE Biomedical Circuits and Systems Conference (BioCAS): Intelligent Biomedical Systems. 2008 .

Friel, D. D. and Chiel, H. J. (2008) Calcium dynamics: Analyzing the Ca^{2+} regulatory network in intact cells. Trends in Neurosciences. 31: 8 - 19.

Chiel, H. J. and Beer, R. D. (2008) Computational Neuroethology, In Larry Squire et al. (eds.), *The New Encyclopedia of Neurosciences*, Elsevier Ltd., Oxon, England, vol. 3, pp. 23 - 28.

Neustadter, D. M., Herman, R. L., Drushel, R. F., Chestek, D. W. and Chiel, H. J. (2007) The kinematics of multifunctionality: Comparisons of biting and swallowing in *Aplysia californica*. Journal of Experimental Biology 210: 238 - 260.

Phattanasri, P., Chiel, H. J., and Beer, R.D. (2007) The dynamics of associative learning in evolved model circuits. Adaptive Behavior. 15(4):377 - 396.

Chiel, H. J. (2007) *Aplysia* Feeding Biomechanics. Scholarpedia, p.22386

Nishikawa, K, Biewener, A. A., Aerts, P., Ahn, A. A., Chiel, H. J. , Daley, M. A., Daniel, T. L., Full, R. J., Hale, M. E., Hedrick, T. L., Lappin, A. K. , Nichols, T. R., Quinn, R. D., Satterlie, R. A. and Szymik, B. (2007) Neuromechanics: An integrative approach for understanding motor control, Integrative and Comparative Biology, 47: 16 – 34 (Advance Access published May 27, 2007; doi:10.1093/icb/icm024).

Narasimhan, S., Tabib-Azar, M., Chiel, H. J. and Bhunia, S. (2007) Neural data compression with wavelet transform: A vocabulary based approach. Third International IEEE Engineering in Biology and Medicine Society (EMBS) Conference on Neural Engineering, 2 -5 May 2007, Kohala Coast, Hawaii, USA.

Azin, M., Chiel, H. J. and Mohseni, P. (2007) Comparisons of FIR and IIR implementations of a subtraction-based stimulus artifact rejection algorithm. Conf. Proc. IEEE Eng. Med. Biol. Soc. 1: 1437 - 1440.

Roham, M., Halpern, J. Martin, H., Chiel, H. and Mohseni, P. (2007) Diamond microelectrodes and CMOS microelectronics for wireless transmission of fast-scan cyclic voltammetry, 29th International Conference IEEE Engineering in Biology and Medicine Society (EMBS), 23 - 28 August 2007, Lyon, France. Conf. Proc. IEEE Eng. Med. Biol. Soc. 1:6043 - 6.

Ye, H., Morton, D. W., and Chiel, H. J. (2006) Neuromechanics of multifunctionality during rejection in *Aplysia californica*. Journal of Neuroscience 26: 10743 - 10755.

Novakovic, V.A., Sutton, G.P., Neustadter, D.M., Beer, R.D. and Chiel, H.J. (2006) Mechanical reconfiguration mediates swallowing and rejection in *Aplysia californica*. Journal of Comparative Physiology – A. 192: 857 – 870.

Chestek, C. A., Samsukha, P., Tabib-Azar, M., Harrison, R. R., Chiel, H. J. and Garverick, S. L. (2006) Microcontroller-based wireless recording unit for neurodynamic studies in saltwater, IEEE Sensors Journal. 6: 1105 – 1114.

Ye, H., Morton, D. W. and Chiel, H. J. (2006) Neuromechanics of coordination during swallowing in Aplysia californica. Journal of Neuroscience 26:1470-1485.

Halpern, J. M., Xie, S., Sutton, G. P., Higashikubo, B. T., Chestek, C. A., Lu, H., Chiel, H. J. and Martin, H. B. (2006) Diamond electrodes for neurodynamic studies in *Aplysia californica*, Diamond and Related Materials. 15:183-187.

Chiel, H. J. (2005) Joseph, the Master of Dreams. Tradition 39(1):5 - 20. [A novel analysis of the Biblical narrative of Joseph and his brothers]

Li, X., Gutierrez, D. V., Hanson, M. G., Han, J., Mark, M.D., Chiel, H., Hegemann, P., Landmesser, L.T., and Herlitze, S. (2005) Fast non-invasive activation and inhibition of neural and network activity by vertebrate rhodopsin and green algae channelrhodopsin. Proceedings of the National Academy of Sciences (USA) 102 (49); 17816 - 17821.

Mangan, EV, Kingsley, DA, Quinn, RD, Sutton, GP, Mansour, JM and Chiel, HJ. (2005) A biologically inspired gripping device. Industrial Robot *32:49-54*.

Sutton GP, Mangan EV, Neustadter DM, Beer RD, Crago PE, Chiel HJ. (2004) Neural control exploits changing mechanical advantage and context dependence to generate different feeding responses in *Aplysia*. Biol Cybern. *91*, 333-345.

Sutton GP, Macknin JB, Gartman SS, Sunny GP, Beer RD, Crago PE, Neustadter DM, Chiel HJ. (2004) Passive hinge forces in the feeding apparatus of Aplysia aid retraction during biting but not during swallowing. J Comp Physiol A 190: 501-514.

Neustadter DM and Chiel HJ. (2004) Imaging freely moving subjects using continuous interleaved orthogonal magnetic resonance imaging, Magn Reson Imaging *22*, 329 – 343.

Chestek, C., Samsukha, P., Tabib-Azar, M., Harrison, R., Chiel, H. and Garverick, S. (2004) Wireless multi-channel sensor for neurodynamic studies. Third IEEE International Conference on Sensors, Vienna, Austria, October 24 – 27, 2004.

Ovryn, B., Li, X., Chiel, H. and Herlitze, S. (2004) Optical control of a rhodopsin-based switch, in Three Dimensional and Multidimensional Microscopy: Image Processing and Acquisition XI, edited by Concello, J-A, Cogswell, C. J. and Wilson, T., Proceedings of SPIE Vol. 5324 (SPIE, Bellingham, WA), pp. 197 – 207.

Mangan, E. V., Kingsley, D. A., Quinn, R. D., Sutton, G. P., Mansour, J. M. and Chiel, H. J. (2004) A biologically inspired gripping device. International Conference on Intelligent Manipulation and Grasping (IMG04), Genoa, Italy, July 1, 2004.

Beer, R.D. and Chiel, H.J. 2003. Locomotion, invertebrate. In M. A. Arbib (ed.), *The Handbook of Brain Theory and Neural Networks*, 2nd edition, MIT Press.

Neustadter, D. M., Drushel, R. F., Crago, P. E., Adams, B. W., and Chiel, H. J., 2002, A kinematic model of swallowing in *Aplysia californica* based on radula/odontophore kinematics and *in vivo* MRI, *Journal of Experimental Biology* 205:3177-3206.

Mangan, E. V., Kingsley, D. A., Quinn, R. D. and Chiel, H. J., 2002, Development of a peristaltic endoscope, International Congress on Robotics and Automation 2002, pp. 347-352.

Drushel, R. F., Sutton, G. P., Neustadter, D. M., Mangan, E. V., Adams, B. W., Crago, P. E. and Chiel, H. J., 2002, Radula-centric and odontophore-centric kinematic models of swallowing in *Aplysia*, *Journal of Experimental Biology* 205: 2029-2051.

Neustadter, D. M., Drushel, R. F., and Chiel, H. J., 2002, Kinematics of the buccal mass during swallowing based on magnetic resonance imaging in intact, behaving *Aplysia californica*, *Journal of Experimental Biology* 205:939-958.

Chiel, H. J. and Beer, R. D., 2000, Neural networks and Behavior, in *Embryonic Encyclopedia of Life Sciences*, Nature Publishing Group: London, www.els.net.

Chiel, H. J. and Beer, R.D., 2000, Commentary: Biomechanical studies clarify pattern generator circuits, in *Biomechanics and Neural Control of Movement*, Winters J. M. and Crago, P. E., eds., Springer-Verlag, pp. 218 - 220.

Beer, R. D. and Chiel, H. J., 2000, Commentary: Neural control and biomechanics in the locomotion of

insects and robots, *Biomechanics and Neural Control of Movement*, Winters J. M. and Crago, P. E., eds., Springer-Verlag, pp. 240 - 242.

Vaidyanathan, R., Chiel, H. J., and Quinn, R.D., 2000, A hydrostatic robot for marine applications. Robotics and Autonomous Systems 30:103 - 113.

Yu, S.-N., Crago, P. E., and Chiel, H. J., 1999, Biomechanical properties and a kinetic simulation model of the smooth muscle I2 in the buccal mass of *Aplysia*. *Biological Cybernetics* 81:505 - 513.

Chiel, H. J., Beer, R. D., and Gallagher, J. C., 1999, Evolution and analysis of model CPGs for walking I. Dynamical modules. *Journal of Computational Neuroscience* 7:99 - 118.

Beer, R. D., Chiel, H. J., and Gallagher, J. C., 1999, Evolution and analysis of model CPGs for walking II. General principles and individual variability. *Journal of Computational Neuroscience* 7:119 - 147.

Beer, R. D., Chiel, H. J., and Drushel, R. F., 1999, Using autonomous robotics to teach science and engineering.*Communications of the Association for Computing Machinery* 42:85 - 92.

Neustadter, D.M., Drushel, R. F., Crago, P. E., and Chiel, H. J., 1998, Modeling the Biomechanics of Molluscan Feeding, *Comments on Theoretical Biology* 5:119-143

Beer, R. D., Chiel, H. J., Quinn, R. D., and Ritzmann, R. E., 1998, Biorobotic approaches to the study of motor systems, *Current Opinion in Neurobiology* 8:777-782.

Drushel, R. F., Neustadter, D. M., Hurwitz, I., Crago, P. E. and Chiel, H. J., 1998, Kinematic models of the buccal mass of *Aplysia*, *J. Exp. Biol.* 201:1563-1583.

Chiel, H. J. and Beer, R.D., 1997, The Brain has a Body: Adaptive behavior emerges from interactions of nervous system, body, and environment, *Trends in Neurosciences* 20:553 - 557.

Yu, S.-Y., Crago, P. E., and Chiel, H. J., 1997, A non-isometric kinetic model of smooth muscle, *Amer. J. Physiol.* 272: *Cell Physiol.* 41: C1025 - C1039.

Drushel, R. F., Neustadter, D. M., Shallenberger, L.L., Crago, P.E., and Chiel, H.J., 1997, The kinematics of swallowing in the buccal mass of *Aplysia californica*, *J. Exp. Biol.* 200: 735 - 752.

Vaidyanathan, R., Chiel, H.J., and Quinn, R. D., 1997, A hydrostatic robot for marine applications, *Eleventh Symposium on Structural Dynamics and Control*, Virginia Tech.

Beer, R.D., Quinn, R.D., Chiel, H.J., and Ritzmann, R.E., 1997. Biologically-inspired approaches to robotics, *Communications of the Association for Computing Machinery*, 40:30 - 38.

Chiel, H.J., 1996, Critical thinking in a neurobiology course, *Bioscene: Journal of College Biology Teaching* 22:3 - 14.

Hurwitz, I, Neustadter, D., Morton, D. W., Chiel, H. J., and Susswein, A.J., 1996. Activity patterns of the B31/B32 pattern initiators innervating the I2 muscle of the buccal mass during normal feeding movements in *Aplysia californica*, *J. Neurophysiol.* 75:1309-1326.

Espenschied, K. S., Quinn, R. D., Chiel, H. J., and Beer, R. D., 1996, Biologically-based distributed control and local reflexes improve rough terrain locomotion in a hexapod robot, *Robotics and Autonomous Systems*, 18:59 - 64.

Warman, E. N. and Chiel, H.J. 1995. A new technique for chronic single extracellular recording in freely behaving animals using pipette electrodes, *J. Neurosci. Methods*, 57:161-169.

Beer, R.D. and Chiel, H.J. 1995. Locomotion, invertebrate. In M. A. Arbib (ed.), *The Handbook of Brain Theory and Neural Networks*, MIT Press, pp. 553 - 556.

Beer, R.D., Ritzmann, R.E. and Chiel, H.J. 1995. Models of the neural basis of insect behavior. In *An Introduction to Neural and Electronic Networks*, 2nd ed., Zornetzer, S.F., Davis, J.L., Lau, C., and McKenna, T. (eds), Academic Press, San Diego, CA, pp. 165 - 184.

Espenschied, K. S., Quinn, R. D., Chiel, H. J., Beer, R. D., 1994. Biologically-inspired hexapod robot control. In: *Proceedings of the Fifth International Symposium on Robotics and Manufacturing (ISRAM)*.

Morton, D. W. and Chiel, H. J. 1994. Neural architectures for adaptive behavior. *Trends in Neurosciences*, 17:413-420.

Morton, D. W. and Chiel, H. J. 1993. The timing of activity in motor neurons that produce radula movements distinguishes ingestion-like and rejection-like motor patterns in a reduced preparation of *Aplysia*, *J. Comp. Physiol. A.,* 173:519 - 536.

Espenschied, K. S., Quinn, R. D., Chiel, H. J., and Beer, R. D. 1993. Leg coordination mechanisms in stick insect applied to hexapod robot locomotion, *Adaptive Behavior*, 1(4):455 - 468.

Chiel, H. J. and Susswein, A. J. 1993. Learning that food is inedible in freely-behaving *Aplysia californica*, *Behavioral Neuroscience*, 107(2):327-338.

Morton, D. W. and Chiel, H. J. 1993. *In vivo* buccal nerve activity that distinguishes ingestion from rejection can be used to predict behavioral transitions in *Aplysia*, *J. Comp. Physiol. A.,* 172:17-32.

Srinivasan, R. and Chiel, H. J. 1993. Fast calculation of synaptic conductances. *Neural Computation*, 5(2): 200 - 204.

Chiel, H. J., 1993. Cognitive Neuroethology: An Approach to Understanding Biological Neural Networks, in *Intelligent Systems -- Concepts and Applications*, L. Sterling, ed., Plenum Press, pp. 143 - 167.

Chiel, H. J. and Beer, R. D. 1993. Neural and Peripheral Dynamics as Determinants of Patterned Motor Behavior, in *The Neurobiology of Neural Networks*, D. Gardner, ed., M.I.T. Press, pp. 137 - 164.

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Invited Presentations

2/2/84 - Department of Zoology, University College London, London, UK, "Modulation of Complex Behavior".

4/15/85 - Department of Biology, University of Pennsylvania, Philadelphia, PA, "Modulation of Feeding Behavior in a Simple Invertebrate, *Aplysia*"

3/10/86 - Department of Molecular Biophysics Research, AT&T Bell Laboratories, Murray Hill, NJ, "Neural Basis of Complex Behavior in *Aplysia*".

10/27/86 - Department of Neurobiology, Harvard Medical School, Boston, MA, "Presynaptic

inhibition and the coordination of feeding behavior in *Aplysia*".

1/22/87 - Department of Biology, CWRU, Cleveland, OH, "Presynaptic inhibition and the coordination of feeding behavior in *Aplysia*".

1/28/87 - Department of Neurosurgery, Tufts University Medical School, Boston, MA, "Presynaptic inhibition and the coordination of feeding behavior in *Aplysia*".

3/4/87 - Department of Anatomy and Cell Biology, State University of New York, Health Science Center at Brooklyn, Brooklyn, NY, "Presynaptic inhibition and the coordination of feeding behavior in *Aplysia*".

10/20/87 - Invited paper for Proceedings of IEEE Systems Man and Cybernetics, Alexandria, VA, "Associative Neural Networks and Central Pattern Generators: An Experimental Perspective."

2/24/88 - Center for Neurosciences, Medical School, CWRU, Cleveland, OH, "Feeding in *Aplysia*: A model system for the study of complex behavior"

3/28/88 - Department of Physics, CWRU, Cleveland, OH, "Biological and theoretical neural networks: is there a connection?"

10/2/88 - Invited Platform talk, Cell and Molecular Neurobiology of *Aplysia*, Cold Spring Harbor, NY, "Analysis of presynaptic inhibition using *Aplysia* neurons in culture"

10/11/88 - Department of Pharmacology, Medical School, CWRU, Cleveland, OH, "Role of a histaminergic neuron in the feeding behavior of *Aplysia*"

4/5/89 - Cleveland Neuropsychological Association, Cleveland, OH, "Neural Networks for Adaptive Behavior"

5/10/89 - Annual Sigma Xi Lecture, CWRU Chapter, Cleveland, OH, "Neural Networks for Adaptive Behavior"

6/20/89 - International Joint Conference on Neural Networks, Washington, D.C., "A lesion study of a heterogeneous artificial neural network for hexapod locomotion"

11/16/89 - Department of Pulmonary Medicine, CWRU, Cleveland, OH, "Cellular basis of feeding in *Aplysia*"

1/24/90 - The Neural Computation Project, The Salk Institute, San Diego, CA, "Biologically based neural networks for autonomous behavior in an artificial insect"

1/25/90 - Computation and Neural Systems Department, California Institute of Technology, Pasadena, CA, "Experimental and simulation studies of invertebrate neural networks", and "Biologically based neural networks for autonomous behavior in an artificial insect"

5/17/90 - National Science Foundation Workshop, Bio-Control by Neural Networks, Washington, D.C., "Control of Locomotion in a Simulated Insect Using Heterogeneous Neural Nets".

9/26/91 - Department of Biology, CWRU, Cleveland, OH, "*Aplysia* feeding as a model system for the study of adaptive behavior".

11/3/91 - Office of Naval Research Workshop, Novel Robotic Actuators, Washington, D.C., "Adaptive neural control and biomechanics of a muscular grasper: The feeding apparatus of *Aplysia*."

3/31/92 - Jacques Monod Conference, Locomotion: from neural networks to Cognition, Aussois, France, "Simulation of adaptive behavior in a hexapod".

9/21/92 - Department of Psychology, CWRU, Cleveland, OH, "Analysis and Synthesis of Adaptive Behavior in Simpler Animals".

10/1/92 - Howard Hughes Medical Institute, 1992 Undergraduate Program Directors Meeting, Bethesda, M.D., "Interdisciplinary Programs for Undergraduates".

10/21/92 - Department of Mathematics, CWRU, Cleveland, OH, "Dynamics of Adaptive Behavior".

1/11/93 - MetroHealth Medical Center, Cleveland, OH, Basic Science for the Clinician VI, "Principles of Neurobiology".

5/20/93 - Case School of Engineering, Intelligent Systems - Concepts and Applications: A Symposium in Honor of Professor Yoh-Han Pao, CWRU, Cleveland, OH, "Cognitive Neuroethology: An Approach to Understanding Biological Neural Networks".

6/20/93 - Department of Biology, Hebrew University, Jerusalem, Israel, "Analysis and Synthesis of Adaptive Behavior in Simpler Animals".

7/21/93 - Santa Fe Institute Workshop, Dynamic Control of Stability and Flexibility in the Nervous System (organizer: Dr. Nancy Kopell), Santa Fe, New Mexico, "Dynamics of Adaptive Behavior".

10/19/93 - Department of Biological Sciences, University of Illinois at Chicago, Chicago, Illinois, "Analysis and Synthesis of Adaptive Behavior".

1/12/94 - Department of Cellular and Molecular Physiology, Yale University School of Medicine, New Haven, Connecticut, "Neural Networks for Adaptive Behavior".

2/2/94 - Department of Neuroscience, Case Western Reserve University School of Medicine, Cleveland, OH, "Neural Networks for Adaptive Behavior".

2/7/94 - Department of Biology, Georgia State University, Atlanta, GA, "Neural Networks for Adaptive Behavior".

4/28/94 - National Science Foundation Workshop, Establishing databases of identified neurons (Gwen Jacobs and Chris Comer, organizers), Arlington, VA, Discussion leader, "Database formats; solutions for different organisms".

10/4/94 - Howard Hughes Medical Institute, 1994 Program Directors Meeting, Undergraduate Biological Sciences Education Program, Chevy Chase, MD, "Demonstrations of Educational Technology".

12/8/94 - Neuroscience Group, Oberlin College, Oberlin, OH, "The Neural Basis of Adaptive Behavior in the Marine Mollusc *Aplysia*".

1/26/95 - M.I.T. Club of Northeast Ohio, Cleveland, OH, "Simpler Animals and Smarter Robots".

6/2/95 - Krasnow Institute for Advanced Study, Workshop on Evolution, Neurobiology and Behavior, Fairfax, VA, "Neural Architectures for Adaptive Behavior".

6/22/95 - Department of Medical Physiology, University of Calgary Medical School, Calgary, Canada, "Neural Mechanisms of Adaptive Behavior".

10/27/95 - Howard Hughes Medical Institute, 1995 Program Directors Meeting, Undergraduate Biological Sciences Education Program, Chevy Chase, MD, Moderator of Workshop "Educational Technology - Off-the-Shelf or Build-it-Yourself?".

1/12/96 - Santa Fe Institute Colloquium Series, Santa Fe, New Mexico, "Coupling of Central and Peripheral Dynamics in Adaptive Behavior".

5/13/96 - Santa Fe Institute, Santa Fe, New Mexico, Workshop on Dynamics, Computation and Cognition, "Cognitive Neuroethology: a neurobiological approach to the study of cognition".

8/30/96 - Guest lecture, English 200, CWRU, "Literature, Language, and the Brain".

10/28/96 - Autonomous Agents Group, Artificial Intelligence Laboratory, MIT, Cambridge, Ma, "Neural Architecture and Biomechanics in the Generation of Adaptive Behavior".

10/29/96 - Volen Center for Complex Systems, Brandeis University, Waltham, MA, "Mechanisms of Adaptive Behavior: Experimental and Theoretical Studies".

5/29/97 - M.I.T., Cambridge, MA, "Biomechanics and Control of Muscular Hydrostatic Structures", Legged Locomotion Workshop.

9/9/97 - Invited speaker at Symposium, Network Modeling, 5th International Conference on Invertebrate Neurochemistry and Neurophysiology, Eilat, Israel, "Neural Networks for Adaptive Behavior and Robotics".

11/12/97 - Department of Neuroscience, Case Western Reserve University School of Medicine, Cleveland, OH, "Biomechanics and Neural Control of Feeding in *Aplysia*".

4/23/98 - Department of Biology, Case Western Reserve University, Cleveland, OH, "Neural and Biomechanical Mechanisms of Adaptive Behavior".

8/25/98 - Invited speaker at Symposium, Modeling neural systems, 5th International Congress of Neuroethology, San Diego, California, "Biomechanics and neural control of the feeding apparatus of *Aplysia californica*".

1/29/99 - Neuromechanics Group, Case Western Reserve University, Cleveland, OH, "Biomechanics and Neural Control of Muscular Hydrostatic Structures"

3/9/99 - Neuroscience Program Seminar Series, Beckman Institute, University of Illinois at Urbana-Champaign, Urbana, Illinois, "Biomechanical and Neural Mechanisms of Adaptive Behavior".

5/2/99 - Participant in Learning and Intelligent Systems Principal Investigators Conference sponsored by the National Science Foundation, Georgetown University Conference Center, Washington, D.C.

11/16/1999 - "Neural and Biomechanical Mechanisms of Adaptive Behavior", Department of Biomedical Engineering, Case Western Reserve University, Cleveland, OH 44106.

6/13/2000 - "Neural and Biomechanical Mechanisms of Adaptive Behavior", MRI Systems Group, GE Medical Systems Magnetic Resonance, Haifa, Israel.

1/16/2001 - "Towards a Theory of Pattern Generation", Workshop on Computational and Mathematical Problems Arising from Neurophysiology, The Rothschild Institute of Computer Science, Haifa University, Haifa, Israel.

6/1/2001 - "Neuromechanical Modeling and Experimental Analysis of Feeding Behavior in *Aplysia*", Stockholm Workshop on Computational Neuroscience, Rimbo, Sweden.

7/11/2001 - "Dynamics of Biological Systems", Nord Lecture Series, Case Western Reserve University, Cleveland, OH.

8/7/2001 - "Neural and Mechanical Mechanisms of Adaptive Behavior", MRI Systems Group, GE Medical Systems Magnetic Resonance, Haifa, Israel.

11/28/2001 - "Neuromechanical Modeling and Experimental Analysis of Feeding Behavior in *Aplysia*", Medical Science Training Program, CWRU, Cleveland, OH.

12/18/2001 - "Towards a Theory of Pattern Generation", MRI Systems Group, GE Medical Systems Magnetic Resonance, Haifa, Israel.

5/30/2002 - "Biomechanics and Neural Control of Adaptive Behavior", Department of Physiology and Biophysics, Mt. Sinai Medical Center, New York, NY.

10/07/2002 – "Biomechanics and Neural Control of Adaptive Behavior", Department of Pathology, CWRU School of Medicine, Cleveland, OH.

09/15/2003 – "Neuromechanical Mechanisms of Adaptive Behavior", The Neuroscience Interest Group, CWRU School of Medicine, Cleveland, OH.

10/21/2003 – "What is an Invention, Who is an Inventor", Technology Transfer Invention Forum, CWRU, Cleveland, OH.

12/01/2003 – "Neuromechanics of Multifunctionality", Center for BioDynamics, Department of Mathematics, Boston University, Boston, MA.

12/04/2003 – "Neuromechanics of Multifunctionality", Concord Field Station, Department of Organismic and Evolutionary Biology, Harvard University, Bedford, MA.

11/11/2004 Wittke Lecture, Case Western Reserve University, Cleveland, OH.

12/02/2004 "Neural and Biomechanical Mechanisms of Multifunctionality in Aplysia californica", Department of Biology, CWRU, Cleveland, OH.

03/08/2005 "Neural and Biomechanical Mechanisms of Multifunctionality in Aplysia: Why a Hand and a Brain are Sometimes Better than a Swiss Army Knife", Department of Neurosciences, Oberlin College, Oberlin, OH.

03/08/2005 "Dynamics of Adaptive Behavior: Theory and Practice", Department of Mathematics, Oberlin College, Oberlin, OH.

04/21/2005 "Dynamics and Plasticity of a Neuromechanical System", Spring 2005 Principal Investigators' Meeting, Collaborative Research in Computational Neuroscience, National Science Foundation, Arlington, VA.

08/11/2005 Discussion Leader, "Sensory and Motor Control: From Animals to Robots", Gordon Research Conference, Neuroethology: Behavior, Evolution and Neurobiology, Magdalen College, Oxford, UK.

09/09/2005 – "Differential Penetrance and Biological Principles", Department of Mathematical Sciences Applied Math Colloquium, New Jersey Institute of Technology, Newark, NJ.

01/05/2006-"Neuromechanics of Multifunctionality", Symposium speaker, "Biomechanics and Neuromuscular Control", organized by Kiisa Nishikawa and Andrew Biewener, Society for Integrative and Comparative Biology 2006 Annual Meeting, Orlando, FL

06/05/2006 – "Dynamics of Multifunctionality", in "Dynamics" session of Spring 2006 Principal Investigator's Meeting, June 4 – 6, 2006, Collaborative Research in Computational Neuroscience, Rosslyn, VA.

03/28/2007 - "Concepts for Cognitive Neuroethology", in "Thinking Animals: Animal Cognition and Consciousness?", a colloquium, sponsored by the Department of Cognitive Science, CWRU.

04/19/2007 - "Highly Parallel Asynchronous Computing at Low Switching Rates: What Can we Learn from the Nervous System?", Department of Electrical Engineering and Computer Science, CWRU.

06/05/2007 - "The Wireless Slug: Monitoring and Manipulating Brain State in Intact, Behaving Animals", PI Talk, Session 6, Collaborative Research in Computational Neuroscience (CRCNS) Principal Investigator's Meeting, University of Maryland College Park, College Park, MD, June 3 - 5, 2007.

07/26/2007 - "Neuromechanics of Multifunctionality", in the Symposium "Understanding neural control in a biomechanical context" (organized by Hillel J. Chiel), The 8th Congress of International Society for Neuroethology, Vancouver, Canada.

10/23/2007 - "Neural and mechanical mechanisms of multifunctionality in *Aplysia*", Department of Biomedical Engineering, Lerner Institute, Cleveland Clinic Foundation, Cleveland, OH.

10/25/2007 - "Neural and mechanical mechanisms of multifunctionality in *Aplysia*", Department of Neurosciences, CWRU.

1/18/2008 - "Mentoring Maxims" (with Dr. Michael Branicky) . Presentation on how to be a successful mentor for the RIBMS program; taped for future use by UCITE.

07/08/2008- "Neural Control of Multifunctionality", The Gonda Brain Research Center, Bar Ilan University, Ramat Gan, Israel.

07/10/2008 - "Neural Control of Mutlifunctionality in *Aplysia*", Summer Program in Undergraduate Research (SPUR) Seminar, Department of Biology, Case Western Reserve University, Cleveland, OH.

04/02/2009 - "A Flexible Grasper: Neuromechanical Control of Multifunctionality", Department of Biology, Case Western Reserve University, Cleveland, OH.

04/23/2009 - "A Flexible Grasper: Neuromechanical Control of Multifunctionality", Department of Biomedical Engineering, Case Western Reserve University, Cleveland, OH.

10/21/2009 "The Brain in its Body: Motor Control and Sensing in a Biomechanical Context", Introductory remarks for Symposium at the Society for Neurosciences meeting, Chicago, IL.

10/21/2009 "Neuromechanics of Multifunctionality", Symposium talk, Society for Neurosciences Meeting, Chicago, IL.

10/06/2010 "Biomechanical analysis provides guidance for analysis of circuit dynamics", Session 3: Cellular and circuit mechanisms of pattern/sequence generation, Bottom-up and top-down approaches to understanding circuit processing: Meeting in the Middle, HHMI Janelia Farm Research Campus, October 3 – 6, 2010.