Mark S. Alber

15611 Pine Tree Ln
Granger, IN 46530
Tel.: 574-273-3864

US citizen

Department of Mathematics
University of Notre Dame
Notre Dame, IN 46556
Tel.: 574-631-8371
e-mail: malber@nd.edu

Fields:

Applied Mathematics, Mathematical Biology, Computational Biology

Education:

1990 -	Ph.D. in Mathematics, *University of Pennsylvania, Philadelphia, PA* advisor: J.E. Marsden, Caltech
1983 -	Honors M.S. in Mathematics, *Department of Applied Mathematics, Moscow Institute of Technology*

Positions Held:

2009 - present	Vincent J. Duncan Family Professor of Applied Mathematics
2006 - 2009	Notre Dame Endowed Chair in Applied Mathematics
2003 - present	Director, Interdisciplinary Center for the Study of Biocomplexity University of Notre Dame
2003 - present	Concurrent Professor of Physics, University of Notre Dame
2008 - 2010	Member of the Editorial Board, Journal of Statistical Physics (Springer)
2009 - current	Field Editor for Mathematical and Computational Methods in Biosciences and Medicine of the Encyclopedia of Applied and Computational Mathematics (Springer)
2001, 2004, 2008	Member of the NSF Panels on Mathematical Physics, Systems and Mathematical Biology
2001 - 2006	Full Professor of Mathematics, University of Notre Dame
1996 - 2001	Tenured Associate Professor, University of Notre Dame
2000 - 2001	On Sabbatical leave at Stanford University, CA
March-June 2001	Senior Fellow, Institute for Pure and Applied Mathematics, UCLA, CA
October 2000	Institute for Mathematics and its Applications (IMA), Minneapolis
1990 - 1996	Assistant Professor, University of Notre Dame
July 1995, 1996	Basic Research Institute in the Mathematical Sciences (BRIMS) Hewlett-Packard Research Lab., Bristol, UK
June 1994	CNLS, Los Alamos Natl. Lab., NM
1993 - 1994	On Sabbatical leave at UC Berkeley, CA; Institute for Advanced Study, Princeton, NJ; Mathematical Sciences Research Institute (MSRI) Berkeley, CA
June 1993	The Fields Institute for Research in Mathematical Sciences, Canada
Summer 1990	Instructor, University of Pennsylvania

Research Support:

NSF Grant DMS-0800612, NSF Mathematical Biology and NIH NIGMS, Integrating Multiscale Modeling and in vivo Experiments for Studying Blood Clot Development, 09/01/08 - 09/01/11, $864,000, PI; The overall goal of this project is to develop 3-dimensional multiscale mathematical models and a computational toolkit for simulating thrombus formation. These models will be validated with specifically designed experiments to test predictions of thrombus development, structure and stability. Moreover, the development of reasonable models will serve as a generator of new hypotheses that can be tested in experiments in vivo. To achieve this goal a collaboration has been formed between Dr Alber and Dr. Xu (Notre Dame), Dr. Rosen (Indiana University Medical School) and Dr. Jiang (Los Alamos National Lab (LANL)).

NSF Grant DMS-0719895, AMS-SS: Multiscale stochastic model of myxobacteria dynamics, 08/15/07-07/31/2010, $200,000, PI; A large amount of available, reliable experimental data on single wild type and mutant cell behavior and interactions between cells will be used as building blocks for developing comprehensive mathematical and computational multidimensional hybrid model of bacterial swarming based on short and long range interactions. To bring different scale levels of description together new mathematical techniques and tools will be used including elements of stochastic analysis, nonlinear analysis and kinetic theory.

NSF Grant 0622940, CompBio: Simulation of self-emerging properties of coupled biochemical and cellular networks in social behavior of Myxobacteria, Biology and Information Technology, 09/01/06-08/31/09, $300,000, Co-PI; The project bridges the molecular, subcellular, cellular, and macroscopic level models by introducing consistent mathematical and computational interfaces among them. This general approach is demonstrated by developing a multiscale computational model of formation of Myxobacteria fruiting bodies based on short range (C-signaling) interactions, differentiation and motility regulation, and by analyzing the effect of genetic mutations on macroscopic development.

NSF 0826958, DHB: Longitudinal Analysis and Modeling of Large-Scale Social Networks, 10/01/08 - 10/01/11, $699,770.00, Co-PI; The data generated by digital communication technologies will be used to (1) test/validate existing social network theories about the mechanisms underlying network dynamics by developing quantitative high fidelity temporal stochastic models of human behavior within social networks; (2) produce a data-driven, dynamic network modeling suite with prediction capabilities.

DOE: Northwest Indiana Computational Grid (NWICG), Modeling Microtubule Dynamics, 09/01/08 - 09/01/09, $50,000, PI; 1) Development of the detailed microscale model of several microtubules formation and parallelized computational implementation. 2) Development of multiscale model of venous thrombosis.

NIH 1 RO1 GM065420: Supplement for the Study of Complex Biological Systems, 08/01/05-07/31/08, $320,000, Co-PI; This grant supported collaboration between cell biologist Holly Goodson and applied mathematician Mark Alber to use a coupled program of iterative computational modeling and experiment to investigate key aspects of dynamic microtubule systems.

NIH 1 RO1 GM76692-01: Interagency Opportunities in Multiscale Modeling in Biomedical, Biological and Behavioral NSF 04.6071, (collaboration with IU Bloomington and Medical School at Kansas University) 09/01/05-08/31/08, $800,000, Co-PI; The investigators developed an open-source comprehensive Tissue-Simulation-Toolkit (TST) using multiscale mathematical modelling and computer simulation techniques to investigate the mechanism of segmentation during somite and limb formation.

NSF Grant 0344647, Division of Integrative Biology and Neuroscience, BIO Directorate and DMS Applied Mathematics, Testing a Developmental Mechanism by an Integrated Empirical-Computational Approach, (collaboration with Medical College of New York) 04/15/04-04/15/07, $360,000, Co-PI; The objective of this project was to define and test an activator-inhibitor based mechanism for skeletal pattern formation in vertebrate limb mesenchymal cells.

NSF MRI Grant 0420980, Acquisition of the Notre Dame Biocomplexity Computer Cluster, 08/01/04-07/31/07, PI; This grant supported the purchase of a Beowulf type Biocomplexity Cluster (62 dual processors nodes with 64-bit architecture) to provide computer infrastructure for The Notre Dame Interdisciplinary Center for the Study of Biocomplexity (ICSB) to meet its broad research and educational goals.

NSF Grant 0083653, BIOCOMPLEXITY Multiscale Simulation of Avian Limb Development (collaboration with IU Bloomington, PI on a Notre Dame subcontract) 9/1/00-8/31/05, $3,000,000. The goal was to develop mathematical and computational models of avian limb structural development based on physical processes including cell adhesion, chemotaxis and haptotaxis, mitosis, and cell differentiation. We introduced unified, object-oriented, three-dimensional computational framework which includes composite discrete and continuous modeling and computation and used it for simulating chondrogenesis in an avian limb. The package is available for uploading at: https://simtk.org/home/compucell3d

REU Supplement to the NSF Biocomplexity Grant 0083653, 06/01/2003-09/01/2007, $25,000, PI.

NSF DMS05-17864, 09/01/05-08/31/06, $25,000, PI; DOE grant $15,000, PI; Indiana 21st Century Research and Technology Fund, $5,000; Workshop on Applications of Methods of Stochastic Systems and Statistical Physics

Burroughs Wellcome Fund, Biocomplexity V Workshop, August 2003, $5,000, PI

NSF Grant DMS 9626672, 1996-2000, Geometric Analysis, PI

Grants from BRIMS, Research Laboratories of Hewlett-Packard, and from the Institute for Mathematics and its Applications, University of Minnesota, Conference on Nonlinear Problems in Applied Mathematics, University of Notre Dame, April 7-9, 2000, PI

NATO Collaborative Research Grant CRG 950897, 1995-99, Applied Mathematics, Notre Dame, CNLS Los Alamos Natl. Lab and Hewlett-Packard Lab., Co-PI

NSF Grant DMS 9508711, 1995-97, Special Projects (Mathematical Sciences), PI

Grant from Research Laboratories of Hewlett-Packard, 1995-97, PI

NSF Grant DMS 9403861, 1994-96, Geometric Analysis, PI

Grant from BRIMS, Research Laboratories of Hewlett-Packard, April 1996, Conference on Recent Developments in Applied Mathematics, PI

Service:

2008-2010: Member of the Editorial Board, Journal of Statistical Physics (Springer)

2009-current: Field Editor for Mathematical and Computational Methods in Biosciences and Medicine of the Encyclopedia Applied and Computational Mathematics (Springer)

2003-current: Director, Interdisciplinary Center for the Study of Biocomplexity, University of Notre Dame

June 23, 2009, Member of the External Scientific Review Board of the NIH Center for Complex Biological Systems, University of California, Irvine

2006-2007: Member of the University of Notre Dame Graduate Council

2005-2006: Member of the University of Notre Dame Council for Academic Technologies

2005-current: Member of the Executive Committee of the Center for Applied Mathematics, University of Notre Dame

2005-2009: Member of the Faculty Advisory Committee of the Center for Research Computing, University of Notre Dame

Organizer, Workshop on Interdisciplinary Biomedical Research, March 1-3, 2009, University of Notre Dame

Organizer, Focus Group Meeting: Multiscale Methods in Biology, NSF Mathematical Biology Institute, Ohio State University, Columbus, OH, November 2-4, 2008

Organizer, Special Session on Multiscale Methods in Biological Modeling: Hybrid Systems and Coarsening Methods, SIAM Meeting in Life Sciences, Montreal, Canada, August 6, 2008

Co-organizer, Workshop on Interdisciplinary Biomedical Research between University of Notre Dame and Indiana University School of Medicine, University of Notre Dame, April 10 - 11, 2008

Organizer, Special Session on Mathematical Biology: Modeling Cancer, AMS Meeting, University of Notre Dame, April 8 - 9, 2006

Co-organizer, Workshop on Stochastic Modelling, University of Notre Dame, March 24-36,

2006

Co-organizer, Special Session on Mathematical Biology, American Mathematical Society Meeting, Notre Dame, April 7-9, 2006

Co-organizer, Workshop on Applications of Methods of Stochastic Systems and Statistical Physics in Biology, University of Notre Dame, October 28-30, 2005

Member of the Scientific Committee, Managing Complexity - Systems Biology, 7th World Congress of Chemical Engineering (WCCE 2005), Glasgow, Scotland, July 4-7, 2005.

Organizer, Biocomplexity Workshop VIII: Applications of Methods of Stochastic Systems and Statistical Physics to Biology, University of Notre Dame, October 28-30, 2005.

Co-organizer, Special Session on Mathematical Biology, American Mathematical Society Meeting, University of Notre Dame, April 8-9, 2006.

Co-organizer, Biocomplexity Workshop VII: Unravelling the Function and Kinetics of Biochemical Networks: from Experiments to Systems Biology, IU Bloomington, May 9 - 11, 2005.

Co-organizer, Biocomplexity Workshop VI: Complex Behavior in Unicellular Organisms, IU Bloomington, May 12 - 16, 2004.

Organizer, Biocomplexity Workshop V: Multiscale Modeling in Biology, University of Notre Dame, August 14 - 17, 2003.

Co-organizer, Biocomplexity Workshop IV: Regenerative Biology and Medicine, University of Indiana, Bloomington, May 15 - 18, 2003.

Co-organizer, Biocomplexity Workshop III: The Role of Tissue Mechanics in Biological Responses to Mechanical Loading, University of Notre Dame, November 8-10, 2002.

Member of a Program Committee of the 17th International Symposium on Mathematical Theory of Networks and Systems, University of Notre Dame, August 12-16, 2002.
Co-organizer of a mini-symposium on applications to biology.

Co-organizer, Notre Dame Workshop on Modeling Cytoskeleton and Cell Motility,
University of Notre Dame, November 10-11, 2001.

Co-organizer of 2 invited Mini-symposiums on Applications of Nonlinear Dynamical Systems in Biology, Fifth SIAM Conference on Control and its Applications held jointly with the 2001 SIAM Annual Meeting, San Diego, July 11-14, 2001.

Co-organizer, Conference on Nonlinear Problems in Applied Mathematics, University of Notre Dame, April 7, 2000.

Co-organizer, Special session on Nonlinear Waves and Integrable Systems, AMS Meeting, University of Notre Dame, April 8-9, 2000.

Reviewer for the N.S.F., Springer, Proc. Natl. Acad. Sci. USA, Journal of Statistical Physics, Physica D, Bull.Math.Biol., Nonlinearity, Biophys.J., Phys.Rev.Lett., Phys.Rev.E.

Special Issues of Journals and Books:

Mark Alber, Field Editor for Mathematical and Computational Methods in Biosciences and Medicine of the Encyclopedia of Applied and Computational Mathematics (Springer) (in preparation).

Mark Alber, Ray Goldstein, Erwin Frey, Editors, Special Issue on Applications to Biology of the Journal of Statistical Physics, *Springer*, Volume 128, Issue 1-2, July 2007.

Mark Alber, Thomas Hou, James A. Glazier, Yi Jiang, Editors, Special Issue on Multiscale Modeling in Biology, SIAM Journal: Multiscale Modeling and Simulation, *SIAM*, Volume 3, Number 2, 2005.

Clay Fuqua, James A. Glazier, Yves Brun and Mark S. Alber, Editor, Special Issue of the Journal: Biofilms, *Cambridge University Press*, Volume 1, Number 4, 2004.

Alber, M.S. , B. Hu and J. Rosenthal, Editors, Current and future directions in applied mathematics [1997]. Papers from the symposium held at the University of Notre Dame, Notre Dame, IN, April 1996. *Birkhuser Boston, Inc., Boston, MA* x+261.

Peer-reviewed Publications:

1. Zhenyu Shi, Nan Chen, Yanan Du, Ali Khademhosseini and Mark Alber, Stochastic model of self-assembly of cell-laden hydrogels, *Phys. Rev. E.* (to appear).
2. Morcos, Faruck, Marcin Sikora, Mark Alber, Dale Kaiser, and Jesus A. Izaguirre, Belief Propagation Estimation of Protein and Domain Interactions using the Sum-Product Algorithm, *IEEE Transactions on Information Theory* (to appear).
3. Morcos, Faruck, Marcin Sikora, Mark Alber, Dale Kaiser, and Jesus A. Izaguirre, Estimation of Protein and Domain Interactions in the Switching Motility System of Myxococcus xanthus. Proceedings of the Pacific Symposium on Biocomputing 2010: Hawaii, USA, 4-8 January 2010 (to appear).
4. Mu, J., X. Liu, M.M. Kamocka, Z. Xu, M.S. Alber, and E.D. Rosen, D.Z. Chen, Segmentation, Reconstruction, and Analysis of Blood Thrombi in 2-Photon Microscopy Images. *EURASIP Journal on Advances in Signal Processing* (to appear).
5. Z. Xu, J. Mu, X. Liu, M.M. Kamocka, E.D. Rosen, D.Z. Chen and M.S. Alber, Combined Experimental and Simulation Study of Blood Clot Formation, Proceedings of the 2009 IEEE Toronto International Conference - Science and Technology for Humanity TIC-STH, Toronto, Canada (to appear).
6. Mu, J., X. Liu, M.M. Kamocka, Z. Xu, M.S. Alber, and E.D. Rosen, D.Z. Chen [2009], Segmentation, Reconstruction, and Analysis of Blood Thrombi in 2-Photon Microscopy Images. Proceedings of the 22nd IEEE Symposium on Computer-Based Medical Systems (CBMS), Albuquerque, New Mexico, IEEE Xplore, ISBN: 978-1-4244-4879-1, 1-8.

7. Alber, M., Gejji, R., B. Kazmierczak [2009], Existence of Global Solutions of a Macroscopic Model of Cellular Motion in a Chemotactic Field, *Applied Mathematics Letters* **22** 1645-1648.

8. Zhu J., Zhang, Y., Newman, S.A., M.Alber [2009], A finite element model based on discontinuous Galerkin methods on moving grids for vertebrate limb pattern formation, *Mathematical Modeling of Natural Phenomena* **4** 4, 131–148.

9. Zhu, J., Y.-T. Zhang, S.A. Newman and M. Alber [2009], Application of discontinuous Galerkin methods for reaction-diffusion systems in developmental biology, *Journal of Scientific Computing* **40** 391-418.

10. Xu, Z., Chen, N., Shadden, S., Marsden, J.E., Kamocka, M.M., Rosen, E.D., and M.S. Alber [2009], Study of Blood Flow Impact on Growth of Thrombi Using a Multiscale Model, *Soft Matter* **5**, 769 –779.

11. Wu, Y., Jiang, Y., Kaiser, D., and M. Alber [2009], Periodic reversal of direction allows Myxobacteria to swarm, *Proc. Natl. Acad. Sci. USA* **106** 4 1222-1227 (featured in the *Nature News*, January 20th, 2009, doi:10.1038/news.2009.43).

12. Lushnikov, P.P., Chen, N., and M.S. Alber [2008], Macroscopic dynamics of biological cells interacting via chemotaxis and direct contact, *Phys. Rev. E.* **78**, 061904.

13. Xu, Z., Chen, N., , Kamocka, M.M., Rosen, E.D., and M.S. Alber [2008], Multiscale Model of Thrombus Development, *Journal of the Royal Society Interface* **5** 705-722.

14. Alber, M., Glimm, T., Hentschel, H.G.E., Kazmierczak, B., and S. Newman [2008], Pattern formation via the Turing instability in a model of chondrogenesis in vertebrate limb, *Bulletin of Mathematical Biology* **70** 460-483.

15. Newman, S., Christley, S., Glimm, T., Hentschel, H.G.E., Kazmierczak, B., Zhang, Y.T., Zhu. J., and M. Alber [2008], Multiscale Models for Vertebrate Limb Development, *Curr Top Dev Biol* **81** 311-340.

16. Wu, Y., Jiang, Y., Kaiser, D., and M. Alber [2007], Social Interactions in Myxobacterial Swarming, *PLoS Computational Biology* **3** 12, e253.

17. Christley, S., M. Alber, and S.A. Newman [2007], Patterns of mesenchymal condensation in a multiscale, quasi-3D discrete stochastic model, *PLoS Computational Biology* **3** 4, e76.

18. Alber, M., Chen, N., Lushnikov, P., and S. Newman [2007], Continuous macroscopic limit of a discrete stochastic model for interaction of living cells, *Physical Review Letters* **99** 168102.

19. Chen, N., Glazier, J.A., Izaguirre, J.A. and M.S. Alber [2007], A Parallel Implementation of the Cellular Potts Model for Simulation of Morphogenesis, *Computer Physics Communications* **76** 670–681.

20. Alber, M., Chen, N., Glimm, T., and P. Lushnikov, A Two-dimensional Multiscale Model of Cell Motion in a Chemotactic Field, A.R.A Anderson, M.A.J. Chaplain, K.A. Rejniak Eds.,Single Cell Based Models in Biology and Medicine, Birkhauser-Verlag, 2007.

21. Christley, S., Newman, S.A., and M. Alber [2007], Agent-based Simulation for Bio-

logical Development, *Cybernetics and Systems* **38** 7, 707–727.

22. Trevor Cickovski, Kedar Aras, Maciej Swat, Roeland M. H. Merks, Tilmann Glimm, H. George E. Hentschel, Mark S. Alber, James A. Glazier, Stuart A. Newman, Jesus A. Izaguirre [2007], From Genes To Organisms Via The Cell: A Problem Solving Environment For Multicellular Development, *Computing in Science and Engineering* **9** 4, 50–60.
23. Christley, S., Newman, S.A., and M. Alber, Agent-Based Model for Developmental Pattern Formation with Multiscale Dynamics and Varying Cell Geometry. In: Mathematical Modeling of Biological Systems, Volume I. A. Deutsch, L. Brusch, H. Byrne, G. de Vries and H.-P. Herzel (eds). Birkhuser, Boston, 155–167 (2007).
24. Jiang,Y., Sozinova, O., and M. Alber [2006], On Modeling Complex Collective Behavior in Myxobacteria, *Advances in Complex Systems* **9** 4, 1–15.
25. Christley, S., Newman, S.A., and M. Alber, Toward Agent-based Simulation in Development Biology, Proceedings of the Agent-directed Simulation Symposium of the Spring Simulation Multi conference (Ed's. Hamilton et al.), pp. 149-156. April 2-6, 2006, Huntsville, Alabama. SCS Press.
26. Sozinova, O., Y. Jiang, D. Kaiser, and M. Alber [2006], A Three-Dimensional Model of Fruiting Body Formation, *Proc. Natl. Acad. Sci. USA* **103** No.46, 17255-17259.
27. Christley, S., Newman, S.A., and M. Alber, Agent-based Simulation for Biological Development, Proceedings of the Eighteenth European Meeting on Cybernetics and Systems Research, Robert Trappl (ed). Austrian Society for Cybernetic Studies, (2006).
28. Gregoretti, I., Margolin, G., Alber, M., and H. Goodson [2006], Modeling microtubule dynamic instability, *Journal of Cell Science* **119** (22) 4781–4788.
29. Margolin, G., Gregoretti, I., H. Goodson, and Alber, M. [2006], Analysis of a microscopic stochastic model of microtubule dynamic instability *Phys. Rev. E.* **74** 041920.
30. Christley, S., Newman, S.A., and M. Alber, Modeling of Pattern Formation in Cell Cultures, Proceedings of the Tenth International Conference on the Simulation and Synthesis of Living Systems, Luis M. Rocha, Larry S. Yaeger, Mark A. Bedau, Dario Floreano, Robert L. Goldstone and Alessandro Vespignani, editors, MIT Press, Cambridge, MA, 49–55 (2006).
31. Yilin Wu, Nan Chen, Matthew Rissler, Yi Jiang, Dale Kaiser, and Mark Alber, CA Models of Myxobacteria Swarming,S. El Yacoubi, B. Chopard, and S. Bandini (Eds.): ACRI 2006, LNCS 4173, Springer-Verlag Berlin Heidelberg, pp. 192-203, 2006.
32. N. Chen, J.A. Glazier and M.S. Alber, A Parallel Implementation of the Cellular Potts Model for Simulation of Cell-Based Morphogenesis, S. El Yacoubi, B. Chopard, and S. Bandini (Eds.): ACRI 2006, LNCS 4173, Springer-Verlag Berlin Heidelberg, pp. 58–67, 2006.
33. Alber, M., Chen, N., Glimm, T., and P. Lushnikov [2006], Multiscale dynamics of biological cells with chemotactic interactions: From a discrete stochastic model to a continuous description, *Phys. Rev. E.* **73** 051901.
34. Sozinova, O., Y. Jiang, D. Kaiser, and M. Alber [2005], A Three-Dimensional Model of Myxobacterial Aggregation by Contact-mediated Interactions, *Proc. Natl. Acad.*

Sci. USA **102** No.32, 11308-11312.

35. Cickovski, T., C. Huang, R. Chaturvedi, T. Glimm, H.G.E. Hentschel, M. Alber, J. A. Glazier, S. A. Newman, J. A. Izaguirre [2005], A Framework for Three-Dimensional Simulation of Morphogenesis, *IEEE/ACM Transactions on Computational Biology and Bioinformatics* **2** 3,1545-5963.
36. Casal, A., C. Sumen, T. Reddy, M. Alber. P. Lee [2005], Agent-Based Modeling of the Context Dependency in T Cell recognition, *Journal of Theoretical Biology* **236** 376391 (corresponding authors: M.Alber and P. Lee).
37. Chaturvedi, R., C. Huang, B. Kazmierczak, T. Schneider, J. A. Izaguirre, T. Glimm, H.G.E. Hentschel, J. A. Glazier, S. A. Newman, M. Alber [2005], On Multiscale Approaches to 3-Dimensional Modeling of Morphogenesis, *Journal of the Royal Society Interface* **2** 3, 237-253.
38. Alber, M., H.G.E. Hentschel, B. Kazmierczak, S.A. Newman [2005], Existence of Solutions to a New Model of Biological Pattern Formation, *Journal of Mathematical Analysis and Applications* **308** 1 175-194.
39. Alber, M., Glimm, T., Hentschel, H.G.E., Kazmierczak, B., and S. Newman [2005], Stability of n-Dimensional Patterns in a Generalized Turing System: Implications for Biological Pattern Formation, *Nonlinearity* **18** 125-138.
40. Alber, M.S., M.A. Kiskowski, Y. Jiang and S.A. Newman [2004], Biological Lattice Gas Models, in Dynamics and Bifurcation of Patterns in Dissipative Systems, G. Dangelmayr and I. Oprea (eds.), World Scientific Series on Nonlinear Science, Vol. 12, World Scientific, Singapore, 2004, pp 274-291.
41. Kiskowski, M.A., Y. Jiang, M.S. Alber [2004], Role of Streams in Myxobacteria Aggregate Formation, *Physical Biology* **1** 173-183.
42. Casal, A., C. Sumen, T. Reddy, M. Alber. P. Lee, A Cellular Automata Model of Early T Cell Recognition, Lecture Notes in Computer Science, Springer-Verlag, Vol. 3305, Springer-Verlag, New York, pp. 553-560, 2004 (corresponding authors: M.Alber and P. Lee).
43. Chaturvedi, R., C. Huang, J. A. Izaguirre, S. A. Newman, J. A. Glazier, M. Alber, A Hybrid Discrete-Continuum Model for 3-D Skeletogenesis of Vertebrate Limb, Lecture Notes in Computer Science, Vol. 3305, Springer-Verlag, New York, pp. 543-552, 2004.
44. Alber, M.S., M.A. Kiskowski, and Y. Jiang [2004], Two-stage aggregate formation via streams in myxobacteria, *Phys. Rev. Lett.* **93** 068301.
45. Alber, M.S., Y. Jiang, and M.A. Kiskowski. [2004], Lattice gas cellular automaton model for rippling and aggregation in myxobacteria, *Physica D* **191**, 343–358.
46. Kiskowski, M.A., M.S. Alber, G.L. Thomas, J.A. Glazier, N. Bronstein, J. Pu, and Newman, S.A. [2004], Interaction between activator-inhibitor coupling and cell-matrix adhesion in a cellular automaton model for chondrogenic patterning, *Developmental Biology* **271**, 372–387 (corresponding authors: M.Alber and S. Newman).
47. Izaguirre, J. A., Chaturvedi, R., Huang, C., Cickovski, T., Coffland, J., Thomas, G., Forgacs, G., Alber, M., Hentschel, G., Newman, S.A., and Glazier, J.A. [2004], CompuCell, a multi-model framework for simulation of morphogenesis, *Bioinformatics*

20, 1129–1137.

48. Chaturvedi, R., Izaguirre, J. A., Huang, C., Cickovski, T., Virtue, P., Thomas, G., Forgacs, G., Alber, M., Hentschel, G., Newman, S. A., and Glazier, J. A. [2003], Multi-model simulations of chicken limb morphogenesis, Lecture Notes in Computer Science, Volume 2659, Springer-Verlag, New York, 39-49.
49. Alber, M.S., Kiskowski, M.A., Glazier, J.A., and Jiang, Y., On Cellular Automaton Approaches to Modeling Biological Cells, in J. Rosenthal and D.S. Gilliam (Eds.), *Mathematical Systems Theory in Biology, Communication, and Finance*, IMA Volume 134, Springer-Verlag, New York, 1-39, 2003.
50. Alber, M.S. and M.A. Kiskowski, M.A. [2001], On Aggregation in CA Models in Biology, *J. Phys. A: Math. Gen.*, **34** 10707-10714.
51. Alber, M.S., R. Camassa, Y. Fedorov, D.D. Holm and J.E. Marsden [2001], The Complex Geometry of Weak Piecewise Smooth Solutions of Integrable Nonlinear PDE's of Shallow Water and Dym Type, *Commun.Math.Phys.* **221** 197–227.
52. Alber, M.S. and Yu.N. Fedorov [2001], Algebraic Geometrical Solutions for Certain Evolution Equations and Hamiltonian Flows on Nonlinear Subvarieties of Generalized Jacobians, *Inverse Problems* **17** 1–26.
53. Alber, M.S., and C. Miller [2001], On Peakon Solutions of the Shallow Water Equation, *Appl.Math.Lett.* **14** 1, 93–98.
54. Alber, M.S. and Yu.N. Fedorov [2000], Wave Solutions of Evolution Equations and Hamiltonian Flows on Nonlinear Subvarieties of Generalized Jacobians, *J.Phys.A: Math.Gen.* **33** 8409–8425.
55. Alber, M.S. [2000], N-Component integrable systems and geometric asymptotics. In "Integrability: the Seiberg-Witten and Whitham equations", eds H.W. Braden and I.M. Krichever, 1–10. Amsterdam: Gordon and Breach Science Publishers.
56. Luther, G.G., M.S. Alber, M.S., J.E. Marsden and J.W. Robbins [2000], Geometry and control of $\chi^{(2)}$ processes and the generalized Poincaré sphere, *J. Opt. Soc. Amer. B.* **17** 6, 932–941.
57. Alber, M.S., R. Camassa and M. Gekhtman [2000], On billiard weak solutions of nonlinear PDE's and Toda flows, *CRM Proc. & Lecture Notes*, AMS, **25** 1–11.
58. Alber, M.S., G.G. Luther and C. Miller [2000], On Soliton-type Solutions of the Equations Associated with N-component Systems, *J. Math. Phys.* **41** 1, 284–316.
59. Alber, M.S., R. Camassa, Y. Fedorov, D.D. Holm and J.E. Marsden [1999], On Billiard Solutions of Nonlinear PDE's, *Phys. Lett. A* **264** 171–178.
60. Alber, M.S., G.G. Luther, J.E. Marsden and J.W. Robbins [1999], Geometry and Control of Three-Wave Interactions, *Fields Inst. Commun.* **24** 55–80.
61. Alber, M.S., G.G. Luther, J.E. Marsden and J.M. Robbins [1998], Geometric phases, reduction and Lie-Poisson structure for the resonant three-wave interaction, *Physica D* **123** 271–290.
62. Alber, M.S. and G.G. Luther [1997], Nonlinear Waves, Nonlinear Optics and the Future of Communications, *Nonlinear Science Today* **4**.

63. Alber, M.S., G.G. Luther and J.E. Marsden [1997], Energy Dependent Schrodinger Operators and Complex Hamiltonian Systems on Riemann Surfaces, *Nonlinearity* **10** 223-242.

64. Alber, M.S., G.G. Luther and J.E. Marsden [1997], Complex Billiard Hamiltonian Systems and Nonlinear Waves, Algebraic aspects of integrable systems, 1–16, Progr. Nonlinear Differential Equations Appl., **26**, Birkhuser, Boston, MA.

65. Alber, M.S. and J.E. Marsden [1996], Semiclassical Monodromy and the Spherical Pendulum as a Complex Hamiltonian System, *Fields Inst. Commun.* **8** 1-18.

66. Alber, M.S., R. Camassa, D.D. Holm and J.E. Marsden [1995], The geometry of weak solitons of certain integrable nonlinear pde's, Proc. Int. Workshop, Nonlinear Evolution Equations and Dynamical Systems, NEEDS'94, Los Alamos Natl. Lab., NM (World Scientific) 3-8.

67. Alber, M.S., R. Camassa, D.D. Holm and J.E. Marsden [1995], On Umbilic Geodesics and Soliton Solutions of Nonlinear PDE's, *Proc. R. Soc. London Ser. A* **450** 677-692.

68. Alber, M.S. and J.E. Marsden [1994], Complex Geometric Asymptotics for Nonlinear Systems on Complex Varieties, *Topol. Methods Nonlinear Anal.* **4** 237-251.

69. Alber, M.S., R. Camassa, D.D. Holm and J.E. Marsden [1994], The geometry of peaked solitons and billiard solutions of a class of integrable pde's, *Lett. Math. Phys.* **32** 137-151.

70. Alber, M.S. and J.E. Marsden [1994], Resonant Geometric Phases for Soliton Equations, *Fields Inst. Commun.* **3** 1-26.

71. Alber, M.S. and J.E. Marsden [1994], Geometric Phases and Monodromy at Singularities, N.M. Ercolani et al., eds., *NATO ASI Series B* (Plenum Press, New York) **320** 273-296.

72. Alber, M.S. and J.E. Marsden [1992], On Geometric Phases for Soliton Equations, *Commun. Math. Phys.* **149** 217-240.

73. Alber, M.S. [1992], Complex geometric asymptotics, geometric phases and nonlinear integrable problems. Huygens' principle 1690–1990: theory and applications (The Hague and Scheveningen, 1990), 415–427, Stud. Math. Phys., 3, *North-Holland, Amsterdam.*

74. Alber, M.S. [1992], On geometric phases and braid groups. Proceedings of the XXth International Conference on Differential Geometric Methods in Theoretical Physics, Vol. 1, 2 (New York, 1991), 439–453, *World Sci. Publishing, River Edge, NJ.*

75. Alber, M.S. [1991], Hyperbolic Geometric Asymptotics, *Asymptotic Anal.* **5** 161-172.

76. Alber, M.S. [1990], Geometric Asymptotics for Integrable Systems, Proc.of the CRM Workshop on Hamiltonian Systems, Transformation Groups and Spectral Transform Methods, CRM, Universite de Montreal (Marquis, Montmagny, Qc).

77. Alber, M.S. [1989], On integrable systems and semiclassical solutions of the stationary Schrodinger equations, *Inverse Problems* **5** 131-148.

78. Alber, M.S. and S.J. Alber [1987], Hamiltonian formalism for nonlinear Schrődinger equations and sine-Gordon equations, *J. London Math. Soc. (2)* **36** 176-192.

79. Alber, M.S. [1987], Hamiltonian formalism for finite-zone solutions of nonlinear integrable equations. Proceedings of the VIIIth international congress on mathematical physics (Marseille, 1986), 447–462, *World Sci. Publishing, Singapore.*

80. Alber, M.S. and S.J. Alber [1985], Hamiltonian formalism for finite-zone solutions of integrable equations, *C. R. Acad. Sci. Paris Sr. I Math.* **301** 777-781.

Recent Invited Talks:

October 27, 2009, Workshop on Self-Organization and Multi-Scale Mathematical Modeling of Active Biological Systems, NSF Statistical and Applied Mathematical Sciences Institute (SAMSI), Research Triangle Park, NC

October 12, 2009, Conference on Agent-Based Complex Systems, NSF Institute for Pure and Applied Mathematics (IPAM), UCLA, Los Angeles, CA

September 26, 2009, Symposium on Engineered and Natural Complex Systems-Modeling, Simulation and Analysis, 2009 IEEE Toronto International Conference - Science and Technology for Humanity, Canada

August 30, 2009, Tutorial Lecture, 2009-10 Program on Stochastic Dynamics, NSF Statistical and Applied Mathematical Sciences Institute (SAMSI), Research Triangle Park, NC

August 24, 2009, Plenary Talk, Workshop, NSF Mathematical Biology Institute, Columbus, OH

July 23, 2009, Invited Talk, Center for Mathematical Biology, Oxford University, UK

July 22, Invited Talk, Conference on Cardiac Physiome Project, Newton Institute, Cambridge University, UK

April 10, 2009, Applied Mathematics Colloquium, Department of Mathematics, Stanford University, Palo Alto, CA

April 3, 2009, Colloquium, Department of Mathematics, New Jersey Institute of Technology, Newark, NJ

April 2, Department of Mathematics, Rutgers University, Piscataway, NJ

March 11, 2009, Department of Mechanical Engineering, University of California, Santa Barbara, CA

November 17, 2008, Department of Control Theory and Dynamical Systems, Caltech, Pasadena, CA

November 14, 2008, Department of Mathematics, University of California, Irvine, CA

October 14, 2008, Pattern Formation and Development in Colonial Organisms, NSF Mathematical Biology Institute, Ohio State University, Columbus, OH

August 6, 2008, Mini symposium on Networks Structure and Dynamics, SIAM Meeting in Life Sciences, Montreal, Canada

July 31, 2008, Mini symposium on Multiscale Modeling in Biology, Annual Meeting of the Society for Mathematical Biology Conference, Toronto, Canada

July 25, 2008, NSF EMT Workshop, Princeton University, NJ

29 February 2008, Department of Systems Biology, Harvard Medical School, Boston

December 10, 2007, Workshop on Biomechanics and Chemotaxis, Johann Radon Institute for Computational and Applied Mathematics (RICAM), Linz, Austria

November 12, 2007, Conference on Microfluids, NSF Mathematical Biosciences Institute, Columbus, Ohio

October 5, 2007, Special Session on Networks, American Mathematical Society regional meeting, De Paul University, Chicago

July 24, 2007, 6th European Conference on Computational Biology (ECCB), Vienna, Austria

June 1, 2007, Plenary Invited Talk, Indy Midwest Regional Bioinformatics Conference, IUPUI Conference Center, Indianapolis, IN

May 21, 2007, Conference on Mathematical Issues in Stochastic Approaches for Multiscale Modeling, Mathematical Sciences Research Institute, Berkeley, CA

March 16, 2007, Applied Mathematics and Computational Science (AMCS) Colloquium, University of Pennsylvania, Philadelphia

March 12, 2007, Department of Genetics, Indiana University Medical School, Indianapolis

December 6, 2006, Inaugural Talk, Center for Complex and Nonlinear Science, University of California at Santa Barbara

October 5, 2006, Perdue University, Lafayette, Indiana

September 21 and 23, 2006, ACRI 2006, University of Perpignan, France

April 19, 2006, International Symposium on Agent Based Modeling and Simulation, Vienna University, Austria

February 16, 2006, University of Michigan, Ann Arbor, MI

February 8, 2006, Johns Hopkins University, MD

December 9, 2005, Special Lecture in Developmental Biology at Stanford University, Palo Alto, CA

December 7, 2005, University of California at Irvine, CA

December 6, 2005, California Institute of Technology, Pasadena

December 5, 2005, University of California at Berkeley, CA

September 7, 2005, Conference on Successes and Failures of Continuous Models for Discrete Systems, University of Bristol, UK

July 18 and 21, 2005, The European Conference on Mathematical and Theoretical Biology - ECMTB05, Dresden, Germany

May 15, 2005, 97th Statistical Mechanics Meeting, Rutgers University, NJ

March 24, 2005, Special Session on Biological Computations, and Chair, Special Session on Advances in the Biological Physics of Morphogenesis, Annual Meeting of the American Physical Society, Los Angeles

March 12, 2005, Complex Systems Program, Northwestern University, Evanston

March 1, 2005, Colloquium, Department of Biological Sciences, University of Notre Dame

Postdoctoral Associates:

2009-present, Chris Sweet, computational and mathematical biology

2009-present, EunJung Kim, computational and mathematical biology

2008-present, Malgorzata Kamocka, Indiana University School of Medicine

2005-2008, Nan Chen, computational and mathematical biology

2005-2008, Gennady Margolin, computational and mathematical biology

2005-2006, Pavel Lushnikov, mathematical biology

2004-2006, Olga Sozinova, mathematical biology

2001-2004, Rajiv Chaturvedi, mathematical biology

2003-2004, Bogdan Kazmierczak, mathematical biology

2001-2002, Xinan Zhang, mathematical biology

1995-1997, Gregory Luther, NSF Math. Sci. Postdoctoral Industrial Research Fellowship

Graduate Students:

2008-present, Joshua Lioi (Mathematics)

2008-present, Cameron Harvey (Physics)

2008-present, Huijing Du (Mathematics)

2007-present, Yuan Liu (Mathematics)

2005-present, Richard Gejji (Mathematics)

2005-present, Jianfeng Zhu (Mathematics)

2005-present, Tanya Salyers (Mathematics)

2005-2009, Yilin Wu (Physics) (currently a postdoctoral associate at Harvard University)

2005-2008, Scott Christley (Computer Science) (currently a postdoctoral associate at UC Irvine)

2003-2008, Matt Rissler (Mathematics) (Assistant Professor of Mathematics, Loras College, Iowa)

2003-2008 Ivan Gregoretti (Biochemistry) (currently a postdoctoral associate at NIH)

2000-2004, Audi Kiskowski (Mathematics) (Assistant Professor of Mathematics, University of South Alabama)

1995-2000, Charles Miller (Mathematics) (currently at NSA)

Masters Students in Applied Mathematics Program (separate from Ph.D. Program):

2007-2008, Zhenyu Shi

2005-2006, Fang Qi

2004-2005, Xuelian Zhu

2002-2004, Mihaela Vajiac

1999-2001, Olga Vasillieva

1998-99, Andrea Bieberich

Undergraduate Students, REU Program:

Summer 2008, Jose Garcia (McNair Scholar), David Sheehan (NSF REU Nano/Bio Summer School)

Summer 2007, Fernando Monjarez (McNair Scholar, now in a Ph.D. program in physics at Texas Tech University), Jeston Edwin Greenwood

Summer 2006, Anudha Mittal (NSF REU Nano/Bio Summer School)

2005-2006: James Boyle

2003-2004: Adam Willis

Summer 2004, Michael Bell

High School Teachers: Summers 2006-2008

Helene Dauerty, Physics teacher, Central High School, Elkhart, Indiana

Tom Finke, Lead Mathematics and Science Teacher, Associate Head of School, Trinity School at Greenlawn, South Bend, Indiana

Mike Sinclair, Physics and mathematics instructor, Kalamazoo Area Mathematics and Science Center, Kalamazoo, Michigan

Professional Societies:

Society for Industrial and Applied Mathematics (SIAM)

Society for Mathematical Biology (SMB)

Newly Developed Courses:

Graduate Course: Multi scale modeling in biology and physics

Graduate Course: Topics in Applied Mathematics, Mathematical Biology

Graduate Course: Nonlinear Dynamical Systems

Cross listed: Mathematical and Computational Modeling in Biology and Physics

Undergraduate Seminar on Interdisciplinary Biological Research: Mathematical and Computational Modeling in Biology

Miscellaneous: Married, two sons