LENWOOD SCOTT HEATH

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Contact Information

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Education

Ph.D., Computer Science, University of North Carolina, Chapel Hill, 1985
Dissertation: **Algorithms for Embedding Graphs in Books**

M.S., Mathematics, University of Chicago, 1976

B.S., Mathematics, University of North Carolina, Chapel Hill, 1975

Research Interests

Algorithms, theoretical computer science, graph theory, bioinformatics, computational biology, probability, symbolic computation, computational algebra, parallel architectures, graph embeddings, topology, computational geometry

Professional Experience

2003– Professor of Computer Science, Virginia Polytechnic Institute and State University, Blacksburg, VA

1993–2003 Associate Professor of Computer Science, Virginia Polytechnic Institute and State University, Blacksburg, VA

1987–1993 Assistant Professor of Computer Science, Virginia Polytechnic Institute and State University, Blacksburg, VA

1985–1987 Instructor of Applied Mathematics, Theoretical Computer Science Group, Department of Mathematics, Massachusetts Institute of Technology, Cambridge, MA

Journal Papers

Published

"Multimodal Networks: Structure and Operations," Lenwood S. Heath and Allan A. Sioson, **IEEE/ACM Transactions on Computational Biology and Bioinformatics 6,** 2009, pp. 321–332.

"Semantics of Multimodal Network Models," Lenwood S. Heath and Allan A. Sioson, **IEEE/ACM Transactions on Computational Biology and Bioinformatics 6,** 2009, pp. 271–280.

"Molecular and Physiological Adaptation to Prolonged Drought Stress in the Leaves of two Andean Potato Genotypes," Srinivasrao P. Mane, Cecilia Vasquez Robinet, Alexander Ulanov, Roland Schafleitner, Luz Tincopa, Amelie Gaudin, Giannina Nomberto, Carlos Alvarado, Christian Solis, Luis Avila Bolivar, Raul Blas, Oscar Ortega, Julio Solis, Ana Panta, Cristina Rivera, Ilanit Samolski, Doris H. Carbajulca, Meredith Bonierbale, Amrita Pati, Lenwood S. Heath, Hans J. Bohnert and Ruth Grene, **Functional Plant Biology 35,** 2008, pp. 669–688.

"Tuber Development Phenotypes in Adapted and Acclimated, Drought-stressed *Solanum tuberosum* ssp. andigena Have Distinct Expression Profiles of Genes Associated with Carbon Metabolism," Jonathan I. Watkinson, Lori Hendricks, Allan A. Sioson, Lenwood S. Heath, Hans J. Bohnert, and Ruth Grene, **Plant Physiology and Biochemistry 46,** 2008, pp. 34–45.

"CMGSDB: Integrating Heterogeneous *Caenorhabditis elegans* Data Sources Using Compositional Data Mining," Amrita Pati, Ying Jin, Karsten Klage, Rich Helm, Lenwood S. Heath, and Naren Ramakrishnan, **Nucleic Acids Research 36 (Database Issue),** 2008, pp. D69–76.

"Early PLDα-Mediated Events in Response to Progressive Drought Stress in Arabidopsis: A Transcriptome Analysis," Srinivasrao P. Mane, Cecilia Vasquez-Robinet, Allan A. Sioson, Lenwood S. Heath, and Ruth Grene, **Journal of Experimental Botany 58**, 2007, pp. 241–252.

"Accessions of *Solanum tuberosum ssp. andigena* Show Differences in Photosynthetic Recovery After Drought Stress as Reflected in Gene Expression Profiles," Jonathan I. Watkinson, Lori Hendricks, Allan A. Sioson, Cecilia Vasquez-Robinet, Lenwood S. Heath, Mary Schuler, Hans J. Bohnert, Merideth Bonierable, and Ruth Grene. **Plant Science 171,** 2006, pp. 745–758.

"Effects of Chronic Ozone Exposure on Gene Expression in *Arabidopsis thaliana* Ecotypes and in *Thellungielia halophila,"* P. H. Li, S. P. Mane, A. A. Sioson, C. V. Robinet, L. S. Heath, H. J. Bohnert, and R. Grene, **Plant Cell and Environment 29**, 2006, pp. 854–868.

"Response Diversity of *Arabidopsis thaliana* Ecotypes in Elevated [Co2] in the Field," P. H. Li, A. Sioson, S. P. Mane, A. Ulanov, G. Grothaus, L. S. Heath, T. M. Murali, H. J. Bohnert, and R. Grene, **Plant Molecular Biology 62**, 2006, pp. 593–609.

"Some Fundamental Operations on Multimodal Networks in Biology," Allan A. Sioson and Lenwood S. Heath. **Philippine Computing Journal 1** 2006, pp. 13–22.

"The Statistics of Identifying Differentially Expressed Genes in Expresso and TM4: A Comparison," Allan A. Sioson, Srinivasrao P. Mane, Pinghua Li, Wei Sha, Lenwood S. Heath, Hans J. Bohnert, and Ruth Grene. **BMC Bioinformatics 7,** 2006, 15 pages in main article; plus 5 pages in 2 additional files.

"XcisClique: Analysis of Regulatory Bicliques," Amrita Pati, Cecilia Vasquez-Robinet, Lenwood S. Heath, Ruth Grene, and T. M. Murali. **BMC Bioinformatics 7,** 2006, 14 pages in main article; plus 16 pages in 7 additional files.

"The PMU Placement Problem," Dennis J. Brueni and Lenwood S. Heath, **SIAM Journal on Discrete Mathematics 19,** 2005, pp. 744–761.

"H++: A Server for Estimating pK(a)s and Adding Missing Hydrogens to Macromolecules," John C. Gordon, Jonathan B. Myers, Timothy Folta, Valia Shoja, Lenwood S. Heath, Alexey Onufriev, **Nucleic Acids Research 33,** 2005, pp. W368-W371, Supplement 2.

"Processor-Efficient Sparse Matrix-Vector Multiplication," Lenwood S. Heath, Calvin J. Ribbens, and Sriram V. Pemmaraju, **Computers and Mathematics with Applications 48,** 2004, pp. 589–608.

"Efficient Algorithms for Finding Conway Polynomials," Lenwood S. Heath and Nicholas A. Loehr, **Journal of Symbolic Computation 38,** 2004, pp. 1003-1024.

"Photosynthetic Acclimation is Reflected in Specific Patterns of Gene Expression in Drought-Stressed Loblolly Pine," Jonathan I. Watkinson, Allan A. Sioson, Cecilia Vasquez-Robinet, Maulik Shukla, Deept Kumar, Margaret Ellis, Lenwood S. Heath, Naren Ramakrishnan, Boris I. Chevone, Layne T. Watson, Leonel Merwe van Zyl, Ulrika Egertsdotter, Ronald R. Sederoff, and Ruth Grene, **Plant Physiology 133(4),** 2003, pp. 1702–1716.

"Sorting by Short Swaps," Lenwood S. Heath and John Paul C. Vergara, **Journal of Computational Biology 10(5),** 2003, pp. 775–789.

"Clustering Mass Spectrometry Data using Order Statistics," Douglas J. Slotta, Lenwood S. Heath, Naren Ramakrishnan, Rich Helm, and Malcolm Potts, **Proteomics 3 (9),** 2003, pp. 1687–1691.

"Studying the Functional Genomics of Stress Responses in Loblolly Pine using the Expresso Microarray Management System," Lenwood S. Heath, Naren Ramakrishnan, Ronald R. Sederoff, Ross W. Whetten, Boris I. Chevone, Craig A. Struble, Vincent Y. Jouenne, Dawei Chen, Leonel Merwe van Zyl, and Ruth Grene, **Comparative and Functional Genomics 3,** 2002, pp. 226–243.

"Role of Superoxide Dismutase (SODs) in Controlling Oxidative Stress in Plants," Ruth Grene, Neval Erturk, and Lenwood S. Heath, **Journal of Experimental Botany 53,** 2002, pp. 1331-1341.

"Constructing Homomorphism Spaces and Endomorphism Rings," Edward L. Green, Lenwood S. Heath, and Craig A. Struble, **Journal of Symbolic Computation 32,** 2001, pp. 101-117.

"The Pagenumber of k-Trees is $O(k)$," Joseph L. Ganley and Lenwood S. Heath, **Discrete Applied Mathematics 109,** 2001, pp. 215–221.

"Sorting by Short Block-Moves," Lenwood S. Heath and John Paul C. Vergara, **Algorithmica 28,** 2000, pp. 323–352.

"Stack and Queue Layouts of Directed Acyclic Graphs: Part I," Lenwood S. Heath, Sriram V. Pemmaraju, and Ann Trenk, **SIAM Journal on Computing 28,** 1999, pp. 1510–1539.

"Stack and Queue Layouts of Directed Acyclic Graphs: Part II," Lenwood S. Heath and Sriram V. Pemmaraju, **SIAM Journal on Computing 28,** 1999, pp. 1588–1626.

"Sorting by Bounded Block-Moves," Lenwood S. Heath and John Paul C. Vergara, **Discrete Applied Mathematics 88,** Second special issue on computational biology, 1998, pp. 181–206.

"Edge-Packing in Planar Graphs," Lenwood S. Heath and John Paul C. Vergara, **Theory of Computing Systems 31,** 1998, pp. 629–662.

"An Experimental Evaluation of Local Search Heuristics for Graph Partitioning," Joseph L. Ganley and Lenwood S. Heath, **Computing 60,** 1998, pp. 121–132.

"Edge-Packing Planar Graphs by Cyclic Graphs," Lenwood S. Heath and John Paul C. Vergara, **Discrete Applied Mathematics 81,** 1998, pp. 169–180.

"Stack and Queue Layouts of Posets," Lenwood S. Heath and Sriram V. Pemmaraju, **SIAM Journal on Discrete Mathematics 10,** 1997, pp. 599–625.

"Graph Embeddings and Simplicial Maps," Lenwood S. Heath, **Theory of Computing Systems 30,** 1997, pp 51–65. Invited submission for the special issue on SPAA '93.

"Envision: A User-Centered Database of Computer Science Literature," Lenwood S. Heath, Deborah Hix, Lucy T. Nowell, William C. Wake, Guillermo A. Averboch, Eric Labow, Scott A. Guyer, Dennis J. Brueni, Robert K. France, Kaushal Dalal, and Edward A. Fox, **Communications of the ACM 38,** 1995, pp. 52–53.

"Optimal and Random Partitions of Random Graphs," Joseph L. Ganley and Lenwood S. Heath, **The Computer Journal 37,** 1994, pp. 641–643.

"New Results for the Minimum Weight Triangulation Problem," Lenwood S. Heath and Sriram V. Pemmaraju, **Algorithmica 12,** 1994, pp. 533–552.

"Heuristics for Laying Out Information Graphs," Joseph L. Ganley and Lenwood S. Heath, **Computing 52,** 1994, pp. 389–405.

"Representing Polyhedra: Faces are Better than Vertices," Lenwood S. Heath, Praveen K. Paripati, and John W. Roach, **Computational Geometry: Theory and Applications 3,** 1993, pp. 327–351.

"Users, User Interfaces, and Objects: Envision, a Digital Library," Edward A. Fox, Deborah Hix, Lucy T. Nowell, Dennis J. Brueni, William C. Wake, Lenwood S. Heath, and Durgesh Rao, **Journal of the American Society for Information Science 44,** 1993, pp. 480–491.

"A Generalized Comparison of Quadtree and Bintree Storage Requirements," Clifford A. Shaffer, Ramana R. Juvvadi, and Lenwood S. Heath, **Image and Vision Computing 11**, 1993, pp. 402-412.

"Laying Out Graphs Using Queues," Lenwood S. Heath and Arnold L. Rosenberg, **SIAM Journal on Computing 21,** 1992, pp. 927–958.

"The Pagenumber of Genus g Graphs is $O(g)$," Lenwood S. Heath and Sorin Istrail, **Journal of the Association for Computing Machinery 39,** 1992, pp. 479–501.

"Comparing Queues and Stacks as Mechanisms for Laying Out Graphs," Lenwood S. Heath, Frank Thomson Leighton, and Arnold L. Rosenberg, **SIAM Journal on Discrete Mathematics 5,** 1992, pp. 398–412.

"Practical Minimal Perfect Hash Functions for Large Databases," Edward A. Fox, Lenwood S. Heath, Qi Fan Chen, and Amjad M. Daoud, **Communications of the ACM 35,** 1992, pp. 105–121.

"Order-Preserving Minimal Perfect Hash Functions and Information Retrieval," Edward A. Fox, Qi Fan Chen, Amjad M. Daoud, and Lenwood S. Heath, invited paper, **ACM Transactions on Information Systems 9,** 1991, pp. 281–308.

"Optimal Embeddings of Butterfly-Like Graphs in the Hypercube," David S. Greenberg, Lenwood S. Heath, and Arnold L. Rosenberg, **Mathematical Systems Theory 23,** 1990, pp. 61–77.

"Covering a Set with Arithmetic Progressions is NP-Complete," Lenwood S. Heath, **Information Processing Letters 34,** 1990, 293–298.

"The Physical Mapping Problem for Parallel Architectures," Lenwood S. Heath, Arnold L. Rosenberg, and Bruce T. Smith, **Journal of the Association for Computing Machinery 35,** 1988, pp. 603–634.

"Embedding Outerplanar Graphs in Small Books," Lenwood S. Heath, **SIAM Journal on Algebraic and Discrete Methods 8,** 1987, pp. 198–218.

Conference Papers

Published

"Using Relative Importance Methods to Model High-throughput Gene Perturbation Screens," Ying Jin, Naren Ramakrishnan, Lenwood S. Heath, and Richard F. Helm, **Computational Systems Bioinformatics: Proceedings of the CSB 2008 Conference,** Stanford, California, 2008, pp. 225–236.

"Using Cost-Sensitive Learning to Determine Gene Conversions," Mark J. Lawson, Lenwood S. Heath, Naren Ramakrishnan, and Liqing Zhang, **Proceedings of Advanced Intelligent Computing Theories and Applications, With Aspects of Artificial Intelligence,** Lecture Notes in Computer Science 5227, Springer, 2008, pp. 1030–1038.

"Predicting Markov Chain Order in Genomic Sequences," Lenwood S. Heath and Amrita Pati, **Proceedings of the IEEE International Conference on Bioinformatics and Biomedicine (BIBM),** IEEE Computer Society Press, 2007, pp. 159–164.

"Genomic Signatures in de Bruijn Chains," Lenwood S. Heath and Amrita Pati, **Proceedings of the Workshop on Algorithms in Bioinformatics (WABI),** Springer Lecture Notes in Computer Science, volume 4645, 2007, pp. 216–227.

"Genomic Signatures from DNA Word Graphs," Lenwood S. Heath and Amrita Pati. **Proceedings of the Third International Symposium on Bioinformatics Research and Applications, ISBRA 2007,** Springer Lecture Notes in Computer Science, volume 4463, 2007, pp. 317–328.

"Expresso and Chips: Creating a Next Generation Microarray Experiment Management Systems," Allan A. Sioson, Jonathan I. Watkinson, Cecilia Vasquez-Robinet, Margaret Ellis, Maulik Shukla, Deept Kumar, Naren Ramakrishnan, Lenwood S. Heath, Ruth Grene, Boris I. Chevone, K. Kafadar, and Layne T. Watson, **Proceedings of the Next Generation Software Workshop, 17th International Parallel and Distributed Processing Symposium (IPDPS'03),** Nice, France, IEEE Computer Society, ISBN 0769519261 (CDROM), 2003, 8 pages.

"Networks in Bioinformatics," Lenwood S. Heath, **Proceedings of the 2002 International Symposium on Parallel Architectures, Algorithms, and Networks (I-SPAN 2002),** 2002, pp. 141–150.

"Computational Approaches to Combining Predictive Biological Models," Douglas J. Slotta, Lenwood S. Heath, Naren Ramakrishnan, Rich Helm, and Malcolm Potts, **Proceedings of the High Performance Computing Symposium, Advanced Simulation Technologies Conference (HPC 2002),** 2002, pp. 75–80.

"Expresso — A Problem Solving Environment for Bioinformatics: Finding Answers With Microarray Technology," Ruth G. Alscher, Boris I. Chevone, Lenwood S. Heath, and Naren Ramakrishnan, **Proceedings of the High Performance Computing Symposium, Advanced Simulation Technologies Conference (HPC 2001),** 2001, pp. 64–69.

"Constructing Endomorphism Rings Via Duals," Edward L. Green, Lenwood S. Heath, and Craig A. Struble, **International Symposium on Symbolic and Algebraic Computation (ISSAC 2000),** 2000, pp. 129–136.

"Efficient Construction of Drinfel'd Doubles," Gerard P. Brunick, Edward L. Green, Lenwood S. Heath, and Craig A. Struble, **International Symposium on Symbolic and Algebraic Computation (ISSAC'99),** 1999, pp. 45–52.

"New Algorithms for Generating Conway Polynomials over Finite Fields," Lenwood S. Heath and Nicholas A. Loehr, **Tenth Annual ACM-SIAM Symposium on Discrete Algorithms (SODA),** 1999, pp. 429–437.

"Opal: A System for Computing Noncommutative Gröbner Bases (System Description)," Edward A. Green, Lenwood S. Heath, and Benjamin J. Keller, **Eighth International Conference on Rewriting Techniques and Applications (RTA-97),** 1997, pp. 331–334.

"Visualizing Search Results: Some Alternatives to Query-Document Similarity," Lucy T. Nowell, Robert K. France, Deborah Hix, Lenwood S. Heath, and Edward A. Fox, **Proceedings of the 19th Annual International ACM SIGIR Conference on Research and Development in Information Retrieval,** 1996, pp. 67–75.

"SWAN: A Student-Controllable Data Structure Visualization System," Clifford A. Shaffer, Lenwood S. Heath, Jeffrey M. Nielsen, and Jun Yang, **Proceedings of ED-MEDIA 96,** 1996, pp. 632–637.

"Using the SWAN Data Structure Visualization System for Computer Science Education," Clifford A. Shaffer, Lenwood S. Heath, and Jun Yang, **Proceedings of the Twenty-Seventh SIGCSE Technical Symposium on Computer Science Education,** 1996, pp. 140–144.

"Recognizing Leveled-Planar Dags in Linear Time," Lenwood S. Heath and Sriram V. Pemmaraju, **Proceedings of Graph Drawing '95,** Springer, Lecture Notes in Computer Science 1027, 1996, pp. 300–311.

"SWAN: A Data Structure Visualization System," Jun Yang, Clifford A. Shaffer, and Lenwood S. Heath, **Proceedings of Graph Drawing '95,** Lecture Notes in Computer Science 1027, 1996, pp. 520–523.

"Progress in Interactive Learning with a Digital Library in Computer Science," Edward A. Fox, N. Dwight DAGS, Clifford A. Shaffer, Lenwood Heath, William C. Wake, Lucy T. Nowell, JAN Lee, Deborah Hix, and H. Rex Hartson, **Proceedings ED-MEDIA 95, World Conference on Educational Multimedia and Hypermedia,** 1995, Graz, Austria, pp. 7–12.

"Lower Bounds for Graph Embeddings Via Algebraic Topology (Extended Abstract)," Lenwood S. Heath, **Proceedings of the Fifth Annual ACM Symposium on Parallel Algorithms and Architectures,** 1993, pp. 311–317.

"A User-Centered Database from the Computer Science Literature," Edward A. Fox, Lenwood S. Heath, and Deborah Hix, **Proceedings of the NSF Scientific Database Projects 1991–1993,** AAAS Workshop on Advances in Data Management for the Scientist and Engineer, Boston, Massachusetts, February 14–16, 1993, Wesley W. Chu, A. F. Cardena, and Ricky K. Taira (Editors), pp. 70–75.

"What If There Were Desktop Access to the Computer Science Literature?" Dennis J. Brueni, Bailey Cross, Edward A. Fox, Lenwood S. Heath, Deborah Hix, Lucy T. Nowell, and William C. Wake, **Proceedings of the 21st Annual ACM Computer Science Conference,** 1993, pp. 15–22.

"A Faster Algorithm for Constructing Minimal Perfect Hash Functions," Edward A. Fox, Qi Fan Chen, and Lenwood S. Heath, **Proceedings of the 15th Annual International Conference on Research and Development in Information Retrieval,** 1992, pp. 266–273.

"Edge Coloring Planar Graphs with Two Outerplanar Subgraphs," Lenwood S. Heath, **Proceedings of the Second ACM-SIAM Symposium on Discrete Algorithms,** 1991, pp. 195–202.

"Graph Layout Using Queues (Extended Abstract)," Lenwood S. Heath, Frank Thomson Leighton, and Arnold L. Rosenberg, **Proceedings of the 28th Annual Allerton Conference on Communication, Control, and Computing,** 1990, pp. 305–314.

"Order Preserving Minimal Perfect Hash Functions and Information Retrieval," Edward A. Fox, Qi Fan Chen, Amjad M. Daoud, and Lenwood S. Heath, **Proceedings of the 13th Annual International Conference on Research and Development in Information Retrieval,** 1990, pp. 279–311.

"Polyhedra: Faces are Better than Vertices (Extended Abstract)," Lenwood S. Heath, P. K. Paripati, and J. W. Roach, **Proceedings of the Second Canadian Conference in Computational Geometry,** 1990, pp. 191–199.

"A More Cost Effective Algorithm for Finding Minimal Perfect Hash Functions," Edward A. Fox, Qi Fan Chen, Lenwood S. Heath, and Sanjeev Datta, **Seventeenth Annual ACM Computer Science Conference,** 1989, pp. 114–122.

"The Pagenumber of Genus g Graphs is $O(g)$," Lenwood S. Heath and Sorin Istrail, **Proceedings of the 19th Annual ACM Symposium on Theory of Computing,** 1987, pp. 388–397.

"Embedding Planar Graphs in Seven Pages," Lenwood S. Heath, **Proceedings of the 25th Annual IEEE Symposium on Foundations of Computer Science,** 1984, pp. 74–83.

Abstracts and Posters

"Constrained Mining of Minimal Separators with Applications to Gene Perturbation Studies (Poster)," Ying Jin, Naren Ramakrishnan, Lenwood S. Heath, and Richard Helm, **Seventh Asia Pacific Bioinformatics Conference (APBC 2009),** Beijing, China, January, 2009.

"Genomic signatures from DNA word graphs (poster)", Amrita Pati and Lenwood S. Heath, Grace Hopper Celebration of Women in Computing, October 17-20, 2007.

"Effects of Drought Stress on Phospholipid Signaling in Arabidopsis (Poster)," Srinivasrao Mane, Cecilia Vasquez-Robinet, Allan A. Sioson, Lenwood S. Heath, and Ruth Grene. InterDrought-II, The Second International Conference on Integrated Approaches to Sustain and Improve Plant Production Under Drought Stress, Rome, Italy, September, 2005. Also presented at the International Conference on Plant Lipid Mediated Signaling: Building Connections, Raleigh, NC, October, 2005.

"XcisClique: Analyzing Regulatory Bicliques in *Arabidopsis thaliana* (Poster)," Amrita Pati, Cecilia Vasquez-Robinet, Lenwood S. Heath, Ruth Grene, and T. M. Murali. 8th Annual Conference on Computational Genomics, Cambridge, MA, November, 2005.

"Clustering Mass Spectrometry Data using Order Statistics (Abstract)," Douglas J. Slotta, Lenwood S. Heath, and Naren Ramakrishnan. First Annual Proteomics Data Mining Conference, Duke University, Durham, NC, September, 2002.

"Identifying Changes in Gene Expression During Drought Stress Using Expresso (Poster)," Jonathan I. Watkinson, Allan A. Sioson, Maulik Shukla, Lenwood S. Heath, Naren Ramakrishnan, Boris I. Chevone, Layne T. Watson, Jennifer W.

Weller, Ronald R. Sederoff, Leonel Merwe van Zyl, and Ruth G. Alscher. Presented at ASPB (American Society of Plant Biologists) Plant Biology 2002, Denver, CO, August, 2002.

"Effects of Drought Stress on Gene Expression Patterns in the Needles of Loblolly Pine Trees: Towards a PSE for the Analysis of Microarray Data (Poster)," Lenwood S. Heath, Naren Ramakrishnan, Ronald R. Sederoff, Leonel Merwe van Zyl, Dawei Chen, Y.-H. Sun, Boris I. Chevone, S.-H. Li, Keying Ye, Ross Whetten, and Ruth G. Alscher. Presented at the Gordon Conference on Biological Regulatory Mechanisms, Holderness, NH, July 2000.

Books

The Problem Solving Handbook for Computational Biology and Bioinformatics, Lenwood S. Heath and Naren Ramakrishnan, editors, Springer, ISBN-13: 978-0387097596. In preparation, 2009.

Graph Separators, with Applications, Arnold L. Rosenberg and Lenwood S. Heath, Kluwer Academic Publishers, Norwell, Massachusetts, ISBN 0-306-46464-0, June, 2001, 264 pp.

Book Chapters

"Stack and Queue Layouts of Directed Acyclic Graphs," Lenwood S. Heath, Sriram V. Pemmaraju, and Ann Trenk, an extended abstract in **Planar Graphs,** William T. Trotter, editor, American Mathematical Society, Providence, Rhode Island, 1993, pp. 5–11.

"Hashing," Steve Wartik, Edward A. Fox, Lenwood S. Heath, and Qi Fan Chen, chapter in **Information Retrieval: Data Structures and Algorithms,** William B. Frakes and Ricardo Baeza-Yates, editors, Prentice-Hall, Engelwood Cliffs, NJ, 1992, pp. 293–362.

Preface

"The Emerging Landscape of Bioinformatics Software Systems," Lenwood S. Heath and Naren Ramakrishnan, Guest editors' introduction to the Special Issue on Bioinformatics Software, **IEEE Computer 35,** July, 2002, pp. 41–45.

Funding

Current

National Science Foundation ITR-0428344: *ITR-(NHS)-(sim): Computational Models for Gene Silencing: Elucidating a Pervasive Biological Defensive Response,* Information Technology Research (ITR), $1,500,000. 09/01/04 - 8/31/09. PI: Lenwood S. Heath. Co-PIs: Richard F. Helm, Alexey Onufriev, Malcolm Potts, Naren Ramakrishnan.

National Institutes of Health Grant 1 R25 GM066354-06: *VT Post Baccalaureate Research and Education,* National Institute of General Medical Sciences. First year: $275,603; second year: $276,635; third year: $277,689; fourth year: $278,793. 03/01/2009 - 01/31/2013. PI: Edward J. Smith; Research Mentor: Lenwood S. Heath, *et al.*

Completed

National Institutes of Health Grant 1 R25 GM066354-01A1: *VT Post Baccalaureate Research and Education,* National Institute of General Medical Sciences. First year: $254,871; second year: $411,184; third year: $413,757; fourth year: $416,407; fifth year: $419,135. 08/04/2003 - 07/31/2008. PI: Edward J. Smith; Research Mentor: Lenwood S. Heath, *et al.*

Department of Defense Multidisciplinary University Research Initiative (MURI), Defense Advanced Research Projects Agency Grant N00014-01-1-0852: *Dryophile Genes to Engineer Stasis-Recovery of Human Cells,* $4,532,622: $2,602,790 (basic 3-year) plus $1,929,832 (2-year option), 05/01/2001 – 05/31/2007. Principal investigator: Malcolm Potts. Senior Personnel: Lenwood S. Heath, Richard F. Helm, Naren Ramakrishnan, Thomas O. Sitz (Virginia Tech), Frederic Bloom, Paul Price (Life Technologies), and John Battista (Louisiana State University).

National Science Foundation Grant ITR-0219322: *ITR: Understanding Stress Resistance Mechanisms in Plants: Multimodal Models Integrating Experimental Data, Databases, and the Literature,* Division of Integrative Biology and Neuroscience (BIO/IBN) — ITR Small grants, $499,973. 09/15/2002 - 08/31/2005. PI: Lenwood S. Heath; Co-PIs: Ruth G. Alscher, Boris I. Chevone, Naren Ramakrishnan, and Layne T. Watson. Supplemental funding of $70,705 received February, 2005; expiration extended until 12/31/2006.

National Science Foundation Grant EIA-01903660: *A Microarray Experiment Management System,* $600,000. 8/01/2001 – 8/31/2004. Principal investigators: Naren Ramakrishnan, Lenwood S. Heath, Layne T. Watson, Ruth G. Alscher, and Jennifer W. Weller (VBI).

Virginia Tobacco Settlement Foundation (VTSF): *Using Molecular Genetics to Target "High Risk" Youth Smokers.* Initial participation with the Virginia Tobacco Prevention Research Consortium, in particular, research in furthering the Expresso project and applying it to the needs of the consortium. $96,000. 3/16/2002 – 3/15/2002. Principal investigators: Naren Ramakrishnan, Lenwood S. Heath.

National Science Foundation Grant INT-0000424: *U.S.-Brazil Cooperative Research: The Fine Algebraic Structure of Derivations and Hochschild Cohomology.* $24,900, 9/1/00–8/31/03. Principal investigators: Daniel R. Farkas, Edward L. Green, and Lenwood S. Heath.

National Science Foundation Grant CCR-9732068: *A System for Symbolic Computation in Hopf Algebras.* $180,000, 8/16/98–8/31/01. Principal investigators: Edward L. Green and Lenwood S. Heath.

Arts and Sciences Pilot Research Project Grant: *Experimenting With Algorithms for Difficult, Non-numeric Problems.* $3,000, 12/96–12/98.

National Science Foundation Grant IRI-9116991: *A User-Centered Database from the Computer Science Literature (REU Supplement).* $8,000, 5/15/92–5/15/93. Principal investigator. Funding to pay two undergraduates to participate in research.

National Science Foundation Grant IRI-9116991: *A User-Centered Database from the Computer Science Literature.* $443,391, 9/15/91–2/28/95. Equipment supplement $29,941, 1992. Principal investigators: Edward A. Fox, Lenwood S. Heath, and Deborah Hix.

National Science Foundation Grant CCR-9009953: *Analyzing Parallel Architectures With Algebraic Topology.* $40,000, 7/15/90–12/31/92. Principal investigator.

Doctoral Students Supervised

Nahla A. Belal, "Two Problems in Computational Genomics" (tentative title), 2006–present.

Amrita Pati, "Graph-Based Genomic Signatures," 2008.

Allan A. Sioson, "Multimodal Networks in Biology," 2005.

Douglas J. Slotta, "Evalutating Biological Data Using Rank Correlation Methods," 2005.

Craig A. Struble, "Analysis and Implementation of Algorithms for Noncommutative Algebra," 2000. Co-advisor with Edward L. Green of the Department of Mathematics.

John Paul A. Vergara, "Sorting by Bounded Rearrangements," 1997.

Benjamin J. Keller, "Algorithms and Orders for Finding Noncommutative Gröbner Bases," 1997. Co-advisor with Edward L. Green of the Department of Mathematics.

Ramana R. Juvvadi, "Perfect Hashing and Some Related Problems," 1993.

Sriram V. Pemmaraju, "Exploring the Powers of Stacks and Queues via Graph Layouts," 1992.

Professional Organizations

Institute of Electrical and Electronics Engineers (IEEE), Senior Member

IEEE Computer Society

International Society for Computational Biology (ISCB)

Society for Industrial and Applied Mathematics (SIAM)
- SIAM Activity Group on Discrete Mathematics
- SIAM Activity Group on Life Sciences