

# Lawrence E. Hunter, PhD

## Personal History

### Current Positions:

University of Colorado, Professor, 2008 to present:  
School of Medicine, Department of Pharmacology  
School of Public Health, Department of Biometrics  
Arts & Sciences (Boulder), Department of Computer Science  
Arts & Sciences (Denver), Department of Biology  
Center for Computational Pharmacology (Director)  
Computational Bioscience Program (Director)  
Biomolecular Structure Program  
Cardiovascular Institute  
Cancer Center  
Human Medical Genetics Program

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## Education

- B.A. in Psychology, 1982, Yale University, *cum laude*.
- M.S. and M.Phil. in Computer Science, 1987, Yale University.
- Ph.D. in Computer Science, 1989, Yale University.
- Thesis: *Knowledge Acquisition Planning: Gaining Expertise Through Experience*, advised by Roger Schank.

## Academic Appointments

Teaching Assistant, Yale University, Computer Science Department 1983-1988.  
Adjunct Assistant Professor, George Mason University, Computational Science and Informatics, 1991-1997  
Adjunct Associate Professor, George Mason University, Computational Science and Informatics, 1997-2000  
Fellow, Krasnow Institute of Advanced Study in Cognition, 1995-2000.  
Associate Professor, University of Colorado School of Medicine, 2000-2008.

## **Other Professional Positions**

### Government Positions

Computer Scientist, National Library of Medicine (NIH), Lister Hill Center, 1989-1999.

Chief of Section, National Cancer Institute (NIH), Section on Molecular Statistics and Bioinformatics, 1999-2000.

National Science Foundation Scientific Database Network Project, Board of Directors, 1992-1996;

### Corporate Positions

Founder & Member of the Board of Directors, Molecular Mining Corporation, 1997-2003

Cooperative Research and Development Agreement (CRADA) with VIPS Systems, Inc. 1998-2000

Consultant, Medical Scientists, Inc. (1998-2005)

Consultant, SmithKlein Beecham, Inc. (1996-2000)

## **Honors, Special Recognition, and Awards**

Engelmore Prize for Innovative Applications of Artificial Intelligence, 2003 (presented by the American Association for Artificial Intelligence)

Fellow, American College of Medical Informatics, 2002-

Regent's Award for Scholarship and Technical Achievement, (the highest honor granted by the National Library of Medicine), 1994.

Meritorious Service Award, National Library of Medicine, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998

Winner, student paper competition, Knowledge Acquisition for Knowledge Based Systems Workshop, 1988.

National Merit Scholar, 1978

## **Membership in professional organizations**

International Society for Computational Biology, 1996-. Founder, 1996; President 1996-2000; Awards Committee Chair, 2003-2005; Finance Committee Chair 2005-2007; member of the Board of Directors, 1996-2007

American Association for Artificial Intelligence, 1984-

American Medical Informatics Association, 1990-, Publications Committee (1990-1993)

International Biomatrix Society, Board of Directors, 1991-1996;

## **Major Committee and Service Responsibilities**

### Departmental

Curriculum Committee, 2000-2004

Faculty Search Committee, 2002-2003

Space Planning Committee, 2003-2007

Graduate Training Committee, 2007

Center for Computational Pharmacology, 2000- (Director)

#### School of Medicine

Strategic Plan Committee, 2002-2003

Research Advisory Committee, 2003-2005

Computational Bioscience Program, 2004- (Director)

#### UCDHSC

Search Committee, Director of the Dennison Library, (2006-2007)

#### CU Boulder

Faculty Search Committee, Computer Science Department (2005)

Molecular Biotechnology Initiative (2005-2006)

#### CU Denver

Steering Committee, CU Denver Center for Computational Biology (2001-2006)

#### CU System

University Without Walls (2002-2004)

Genomics Taskforce (2001-2005)

#### National Scientific Advisory Boards

Rat Genome Database, Scientific Advisory Board, 2007-

Gene Ontology Consortium, Scientific Advisory Board 2004-

Columbia University Department of Biomedical Informatics, External Reviewer 2004

University of Michigan Computational Biology Program, External Reviewer 2003

#### National / International Conference Organizing

Founder, International Conference on Intelligent Systems for Molecular Biology 1993 (Cochair, 1993; Organizing committee 1994-1996). Still the most successful academic conference in bioinformatics

Founder and Cochair, Pacific Symposium on Biocomputing (1996-)

Founder and Program Chair, Rocky Mountain Regional Conference on Computational Biology (2004-)

Program chair, Biotechnology Computing Track, Hawaiian International Conference on System Sciences, 1993, 1994, 1995.

Program chair, Biotechnology Computing Minitrack, Hawaiian International Conference on System Sciences, 1991, 1992

Area Chair for Machine Learning, National Conference on Artificial Intelligence, 1992, 1993.

Program committee, AAAI-91 Workshop on Pattern Recognition and Inference in Molecular Biology, 1991

Program chair, AAAI Spring Symposium on Artificial Intelligence and Molecular Biology, 1990.

Program committee, International Conference on the Biomatrix, 1990

### **Patents**

*A System for Synergistic Combination of Multiple Automatic Induction Methods and Re-Representations of Data.* US Patent 6,449,603, issued September 10, 2002. Licensed to firms in healthcare, insurance and the pharmaceutical industry.

*A Machine Learning Method for Predicting Rare but Significant Events.* US Patent 6,917,926 issued July 12, 2005. Coinventors Hung-Han Chen, Harry Poteat and Kristin Kendall.

### **Review and referee work**

#### Service on Editorial Boards

Associate Editor, *Journal of Biomedical Informatics*, 2002-

Editorial Board, *Journal of Machine Learning Research*, 1999-2004

Special editor, *IEEE Expert*, track on Molecular Biology Applications, 1996.

Associate Editor, *Journal of Artificial Intelligence Research*, 1993-1997

Editorial board, *Artificial Intelligence and Medicine*, 1993-1995

Editorial board, *Journal of Computational Molecular Cell Biology*, 1993-1998

#### Grant Study Sections and Ad Hoc Grant Reviews

Ad hoc reviewer, National Library of Medicine, 2009

Chair, NIAID Special Emphasis Panel ZAI1 MP-I (S4), 2008

Biomedical Library and Informatics Review Committee, National Library of Medicine study section, 2004-2008

Ad hoc reviewer, National Library of Medicine, 1999-2004

Ad hoc reviewer, NIH Roadmap U54 Interdisciplinary Research Consortia, 2007

Ad hoc reviewer, National Institute of General Medical Sciences, 2004

Ad hoc reviewer, National Academy of Sciences, 2003

Genome Canada Research Review Panel, 2001, 2003

Ad hoc reviewer, National Institute for Mental Health, 2000

Human Brain Project (trans-NIH review section), 1997-1999

Ad hoc reviewer, National Institute for Mental Health (Research Contracts), 1998

### **Invited lectures and presentations (highlights)**

*Tools for Scientific Insight*, invited presentation, SRI International, October 2007

*Twenty Years of Planning to Learn*, keynote presentation, Planning to Learn workshop, European Conference on Machine Learning, September 2007

*New ideas for secondary school biology education*, Ewing Marion Kaufmann Foundation, May 2006

*Bioinformatics: Putting Systems Biology Information in Context*, lecture in UCHSC Systems Biology and Biomedical Research Symposium, Dec 2, 2005

*Language, Knowledge and Molecular Biology*, Invited presentation to Yale Bioinformatics Symposium, New Haven, CT, November 3, 2005

*Biomedical Language Processing*, Keynote address to Human Language Technology / Empirical Methods in Natural Language Processing conference, Vancouver, Canada, Oct. 6, 2005

*Biognostic Systems*, Keynote address to Italian Association for Artificial Intelligence conference, Milan, Italy Sept. 20, 2005

*The Role of Community in Computational Biology*, keynote address to the Rocky Mountain Regional Bioinformatics Meeting ("Rocky 1") in Aspen, Colorado, December 5-7, 2003.

*The Era of Biognostic Machines*, keynote address to Association for Computing Machinery Special Interest Group on Applied Computing (ACM-SAC) conference., 2003

*Proteomic Bioinformatics*, Center for Computational Pharmacology mini-symposium, 2003

*Biognostic Machines for Cognitive Disability*, invited address, Coleman Institute annual meeting, 2002

*Bioinformatics and Human Health*, UCHSC Chancellor's Luncheon Address, 2002

*Data Mining for High Throughput Biomedicine*, keynote address to the Research Society on Alcoholism conference, Denver, Colorado, June 2000

*Edgar: Extraction of Drugs, Genes and Relations from the Biomedical Literature*, Pacific Symposium on Biocomputing, January, 2000

*The Role of Machine Learning and Natural Language Processing in Contemporary Drug Discovery*, Pharmacology Grand Rounds, University of Colorado School of Medicine, October, 1999

*Inductive Modeling: Power and Pitfalls*, keynote address to MODEL-IT conference, Wageningen, the Netherlands, November 1998

*Coevolution of Symbol Systems and Behavior*, lecture and workshop, Simulations of Adaptive Behavior conference, Zurich, Switzerland, August 1998.

*Machine Learning for Drug Discovery*, invited address, SmithKline Beecham Data Mining Days, November 1997.

*Computer Science : Biology :: Mathematics : Physics*, MIT Media lab, April 1997

*The Role of Computation in Cognitive Science*, Krasnow Institute for Advanced Study of Cognition Seminar Series, November, 1996.

*Coevolution Learning: Synergetic Evolution of Learning Agents and Problem Representations*, Multistrategy Learning Workshop, June, 1996.

*AI Models for Biology, and Biological Models for AI*, Keynote address, Second International Conference on Intelligent Systems for Molecular Biology, July 1995.

*Computers, Modelling , and Theoretical Biology*, Invited address to the Keystone Center Scientist to Scientist Colloquium, August, 1994

*The National Library of Medicine on the Internet: A Digital Library for Biomedicine*. Invited address to the Computers and Chemistry Division of the American Chemical Society conference, Aug 1994

*Planning to Discover in Molecular Biology*, MIT AI Lab Revolving Seminar Series, April 1994

*Molecular Biology for the Computer Scientist*, Full day tutorial at the Hawaiian International Conference on System Sciences, January 1993. Repeated Jan 1994.

*AI & Molecular Biology*, Plenary address, National Conference on Artificial Intelligence, San Jose, CA, July 1992.

*Megaclustering of Unsegmented Datastreams and Applications to Molecular Biology*, Johns Hopkins Applied Physics Laboratory distinguished lecture series, October 1992.

*Electronic Facilitation of Scientific Communication*, Panel organizer and speaker, International Conference on the Biomatrix, George Mason University, July 1990

*Knowledge Acquisition Planning for Inference from Large Datasets*, Keynote address, 1990 Conference on AI Systems in Government, Washington, DC, May 1990

*Machine Learning: Ready for Industrial Application*, Invited address to Third Annual Artificial Intelligence Forum, Sanibel Island, FL, February, 1989

*Artificial Neural Networks as Theories of Mind*. International Neural Network Society, Boston MA, September, 1988

*Machine Learning for Molecular Biology*. Invited address to the Theoretical Biology and Biophysics Group, Los Alamos National Laboratory, June 1988

*Indexing and Recognition*. AI/BioMed: The First International Conference on Artificial Intelligence and its Impacts in Biology and Medicine, Montpellier, France, September 1986

*Computers and Privacy*. Guest lecture in Constitutional Law, University of Connecticut at Hartford Law School, Dec., 1985.

## **Teaching record**

### Courses taught

2002, 2003 University of Colorado, Denver, BIOL 5099

2002-2007 SoM BIOI 7710, 7711 (each year)

2003-2006 SoM BIOI 7713 (each year)

2008 SoM BIOI 7605

2000 PHCL 6611

2001 PHCL 7611

2003, 2005 BIOI 7792

2004 BIOI 7791

1991-1999 George Mason University *Graduate Computational Bioscience*

#### Lectures given in other courses

2003-2007 PHCL 7561 *Bioinformatics in Drug Discovery*

2004-2007 PHCL 7600 *Innovative Bioinformatics for Pharmacology*

2004-2007 Informatics Elective for Residents *Clinical Bioinformatics*

2001 PHRD 4450 *Ethical Issues in Pharmacy Informatics*

#### Courses Developed

BIOI 7605 Bioethics for Bioinformaticians

BIOI 7710 Survey of Bioinformatics Methods

BIOI 7711 Graduate Bioinformatics 1

BIOI 7712 Graduate Bioinformatics 2

BIOI 7713 Graduate Bioinformatics 3 (now included in 7712)

BIOI 7791 Readings in Bioinformatics

BIOI 7792 Special Topics in Bioinformatics

BIOL 5099 (CU Denver) Molecular Biology for Computer Scientists, Mathematicians and Engineers

#### Administrative Positions

Director, Computational Bioscience Training Program

Principle Investigator, Computational Bioscience Training Grant

#### Teaching Awards

Excellence in Teaching Award, Preventive Medicine and Biometrics Department, 2004.

#### Ph.D. Dissertations Directed

Jeffery L. Krichmar, *A Computational Model of Cerebellar of Saccadic Control*, GMU Computational Science and Informatics, 1997.

Judith E. Devany, *Equation Discovery Through Global Self-Referential Geometric Invariants and Machine Learning*, GMU Information Technology, 1997.

Imran Shah, *Predicting Enzyme Function from Sequence*, GMU Computational Science and Informatics, 1998

Barry Zeeberg, *Whole Genome Information Analysis and Processing*, GMU Computational Science and Informatics, 1999

Robert S. Erb, *Analysis and Modeling of Gene Expression Circuits*, GMU Computational Science and Informatics, 1999

Myriam Abramson, *Learning Coordination Strategies* GMU Information Technology, 2003.

Lorraine Tanabe, *Text mining the biomedical literature for genetic interactions* GMU Computational Science and Informatics, 2003

Ronald Taylor *Reconstruction of metabolic and genetic networks from gene expression perturbation data using a Boolean model: construction of a simulation testbed and an empirical exploration of some of the limits* GMU Computational Science and Informatics, 2003.

Min Hong, *Implicit constraint enforcement to control physically-based biomedical simulation* UCHSC Computational Bioscience 2005

Steve Russell, *Machine Learning and In-silico Modeling for Improved Identification of Peptides from Shotgun Proteomic MS/MS Spectra*. UCHSC Computational Bioscience 2005

Sonia Leach, *Informed Structural Priors for Bayesian Networks: Applications in Molecular Biology Using Heterogeneous Data Sources* Brown University Computer Science 2006

Zhiyong Lu, *Text Mining on GeneRIFs*, UCHSC Computational Bioscience 2007

Anis Karimpour-Fard, *Prediction of protein-protein interactions and function in bacteria* UCHSC Computational Bioscience 2008

#### Formal Junior Faculty Mentoring

Deborah Glueck, Department of Preventive Medicine and Biometrics

Debra Goldberg, Department of Computer Science (Boulder).

#### **Grant support:**

<u>Active Grants (Principle Investigator)</u>	<u>Annual direct costs</u>
NIH 5R01LM009254 <i>Beyond Abstracts: Issues in Mining Full Texts</i>	9/2006-8/2010 \$247,885
NIH 2R01LM008111-04A1 <i>Technology Development for a Molecular Biology Knowledge-base</i>	10/2008-3/2013 \$401,329
NIH 5G08LM009639-02 <i>Construction of a Full Text Corpus for Biomedical Text Mining</i>	9/2007- 9/2010 \$144,924
NIH 5R01GM083649-02 <i>Ontologies and Biomedical Language Processing</i>	9/2007- 8/2011 \$631,600
NIH 5T15LM009451-02 <i>Computational Bioscience Program Training Grant</i>	7/2007-6/2012 \$472,566

#### Active Grants (Co-investigator)

NIH 5R01 DE015191-02 (Richard Spritz, PI) 4/04-3/08  
*Gene Discovery for Craniofacial Disorders*

NIH 5P50 CA058187-09 (Paul Bunn, PI) 9/92-4/08

*SPORE Grant in Lung Cancer*

Canine Health Foundation (Jamie Modiano, PI) 12/2005 – 11/2008

*Spontaneous Canine Tumors as Models for Cancer Gene Discovery*

Pending Grants (Principle Investigator)

Prior Grants (Principle Investigator)

NIH/Clinical Center Research Contract 7/2000-6/2001 \$100,000

*Gene Expression Array Analysis for Investigation of Sepsis*

NIH 1U01 AA13524 9/2001-8/2006 \$500,000

*Neuroinformatics Core for the Integrated Neuroscience Initiative on Alcoholism*

Genetics Institute / Wyeth-Ayerst 9/2001-8/2003 \$113,650

*Development of Biological Literature Text Mining Software*

Prior Grants (Co-investigator)

NIH 5P01 HL68743 (Edward Abraham, PI) 9/2002-8/2007

*Heterogeneous neutrophil responses in acute lung injury*

NIH 1 R24 AA13162-01 (Boris Tabakoff, PI) 4/2001-3/2006

*Gene Expression Array Technology Center for Alcohol Research*

NIH 1M01 RR00051 (Robert Eckel, PI) 4/2002-3/2007

*University of Colorado General Clinical Research Center.*

NIH 5 P30 CA46934-15 (Paul Bunn, PI) 3/1988-1/2006

*Cancer Center Support Grant.*

NIH P01 HL67671-01 (Robert Mason, PI) 7/2001-6/2004

*SCOR: Pathobiology of Fibrotic Lung Disease.*

Cystic Fibrosis Foundation, (David Rodman, PI) 4/2001-3/2003

*Effects of Pseudomonas aeruginosa on Inflammatory Gene Expression.*

NIH 5R01HL072340-02 (Mark Geraci, PI) 10/2002-9/2005

*Application of expression analysis to study disease pathogenesis*

## **Philanthropic gifts received**

IBM, 2007: \$24,000 UIMA Innovation Award

Hibernia, Inc., 2006: \$500 Fund for computational bioscience recruiting

Oracle, 2005: CIT Innovation award (license, support & training for Oracle 10g, value \$2500)

Hitachi, 2005: CIT Innovation award (10TB RAID Array, value: \$50,000)

IBM, 2003 (p690 Supercomputer with 64GB of RAM, value \$990,000)

## **Bibliography**

### Peer Reviewed Publications

1. **Hunter, L.**, Schank, RC. Encapsulation and Expectation: A response to Fodor's Modularity of Mind. *Behavioral and Brain Sciences*, 8(1): 29-30, 1985.
2. **Hunter, L.** Indexing and Recognition: Metaknowledge for Organizing Information. *Proceedings of AI/BioMed: The First International Conference on Artificial Intelligence and its Impacts in Biology and Medicine*, Montpellier, France, September 1986, p.93-5
3. **Hunter, L.** Steps Toward building a Dynamic Memory. *Proceedings of the Third International Workshop in Machine Learning*, Skytop, PA, June 1986, p.70-74, Morgan Kaufmann Associates, San Mateo, CA
4. Collins, G., **Hunter, L.**, Schank, RC. Transcending Inductive Category Formation in Learning, *Behavioral and Brain Sciences*, 9(4):639-686, December 1986.
5. **Hunter, L.** and Silbert, J. Progress Report on IVY: A Learning System for Information Retrieval in Pathology, *Proceedings of the Artificial Intelligence and Medicine Workshop*, Seattle WA, 1987.
6. **Hunter, L.** Knowledge Acquisition Planning. *Third Knowledge Acquisition for Knowledge Based Systems Workshop*, Banff, Alberta, Canada, November, 1988 (Winner, best student paper prize)
7. **Hunter, L.** Artificial Neural Networks as Theories of Mind. *Proceedings of First Annual Conference of the International Neural Network Society*, Boston MA, September, 1988, IEEE Computer Society Press, Los Alamitos, CA.
8. **Hunter, L.** Explanation Based Discovery. *Proceedings of the AAAI Symposium on Explanation Based Learning*, Stanford, CA, March 1988, pp. 2-7.
9. **Hunter, L.**, Some Memory, but No Mind: A response to Smolensky's On the Proper Treatment of Connectionism. *Behavioral and Brain Sciences*, 11(1), March 1988
10. **Hunter, L.** Estimating Human Cognitive Capacities *Cognitive Science*, 12(2):257-261, April-June 1988

11. **Hunter, L.** Planning to Learn, *The Proceedings of The Twelfth Annual Conference of the Cognitive Science Society*, Boston, MA., July 1990, pp. 26-34, Lawrence Erlbaum Associates, Hillsdale, NJ.
12. **Hunter, L.** Knowledge Acquisition Planning for Inference from Large Datasets, *The Proceedings of The Twenty Third Annual Hawaii International Conference on System Sciences, Kona, HI. vol. 2, Software track*, pp. 35-44. IEEE Press, 1990.
13. **Hunter, L. & Ram, A.** The Use of Explicit Goals for Knowledge to Guide Inference and Learning, *Proceedings of the Eighth International Workshop on Machine Learning*, Chicago, IL, June 1991, pp. 265-269, Morgan Kaufmann, San Mateo, CA.
14. **Hunter, L.** Applying Bayesian Classification to Protein Structure, *Proceedings of the Seventh Conference on Artificial Intelligence Applications*, vol. 1. Los Alamitos, CA: IEEE Computer Society Press. Feb. 1991; 10-16.
15. **Hunter, L.** Artificial Intelligence and Molecular Biology, *AI Magazine* 11(5):27-36, 1991 Supplement.
16. **Hunter, L.** Bayesian Classification of Protein Structure Fragments, *The Proceedings of The Twenty Fourth Annual Hawaii International Conference on System Sciences; vol. 1.* Los Alamitos, CA: IEEE Computer Society Press. Jan. 1991; 595-604
17. **Hunter, L., Harris, N. & States, DJ.** Megaclassification: Discovering Motifs in Massive Datastreams, *Proceedings of the Tenth National Conference on Artificial Intelligence*, pp. 837-842, 1992, AAAI Press, Menlo Park, CA.
18. **Hunter, L., Harris, N. & States, DJ.** Efficient Classification of Massive, Unsegmented Datastreams, *Proceedings of the Ninth International Workshop on Machine Learning*, pp. 224-233, 1992, Morgan Kaufmann Associates, San Mateo, CA.
19. **Hunter, L. & States, DJ.,** Bayesian Classification of Protein Structure, *IEEE Expert*, 7(4):67-75, 1992.
20. **Hunter, L.** Knowledge Acquisition Planning: Using Multiple Sources of Knowledge to Answer Questions in Biomedicine, *Mathematical and Computer Modeling*, 16(6/7):79-91, 1992.
21. **Hunter, L. & Ram, A.,** Goals for Learning and Understanding. *Journal of Applied Intelligence*. 2(1):47-73, 1992.
22. **Hunter, L.** AI and Grand Challenges in Biotechnology Computing, *Proceedings of the 13th International Joint Conference on Artificial Intelligence*, Morgan Kaufman, San Mateo, CA, Vol. 2, pp. 1677-1683, 1993.
23. Harris, N., **Hunter, L. & States, DJ.** ClassX: A Tool for Browsing Protein Sequence Megaclassifications, *Proceedings of the Twenty-Sixth Annual Hawaii International Conference on System Sciences*, vol. 1, Los Alamitos, CA: IEEE Computer Society Press, Jan 1993; pp 554-563.
24. **Hunter, L. & Klein, T.** Finding Relevant Biomolecular Features, in Hunter, et al., (eds). *Proceedings of the First International Conference on Intelligent*

- Systems for Molecular Biology*, AAAI Press, Menlo Park CA, 1993, pp. 190-197.
25. States, DJ, Harris, N., **Hunter, L.** Computationally Efficient Cluster Representation in Molecular Sequence Megaclassification, in Hunter, et al (eds). *Proceedings of the First International Conference on Intelligent Systems for Molecular Biology*, AAAI Press, Menlo Park CA, 1993, pp. 387-394.
  26. Dowe, D., Allison, L., Dix, T., **Hunter, L.**, Wallace, CS., & Edgoose, T., Circular Clustering of Protein Dihedral Angles by Minimum Message Length, *Pacific Symposium on Biocomputing* (1):242-255. World Scientific Press, 1996.
  27. **Hunter, L.** Coevolution Learning: Synergistic Evolution of Learning Agents and Problem Representations, *Proceedings of 1996 Multistrategy Learning Conference*, pp. 85-94, Menlo Park, CA: AAAI Press, 1996.
  28. Abramson. M. Z. and **Hunter, L.**. Classification using Cultural Coevolution and Genetic Programming. *Genetic Programming: Proc. of the First Annual Conf.* 1996, pp. 249-254, MIT Press, 1996
  29. Krichmar, JL, Olds, JL. & **Hunter, L.** Qualitative Neurobiology, *Proceedings of the 1997 Workshop on Qualitative Reasoning*, pp. 265-276, 1997
  30. Krichmar, JL, Ascoli, G.A., Olds, J.L. and **Hunter, L.** A model of cerebellar saccadic motor learning using qualitative reasoning, *Biological and Artificial Computation: From Neuroscience to Technology* 1240: 133-145 (1997)
  31. Shah, I. & **Hunter, L.** Functional Classification of Enzymes by Sequence Alignment, *Intelligent Systems for Molecular Biology*, 5:276-83 , Menlo Park, CA: AAAI Press 1997
  32. Zeeberg, B.R. & **Hunter, L.** A Hidden Markov Model Whose Alphabet Is Nucleic Acid Triplet Codons and its Use to Discover Chimerism in Protein Families, *Intelligent Systems for Molecular Biology* 5:153-156 , Menlo Park, CA: AAAI Press, 1997
  33. Zeeberg, B.R. & **Hunter, L.** Characterization of a Family of Chimeric Proteins, the Amino Acyl tRNA Synthetases, by Determining Differential Codon Usage using One and Two State HMMs. *Mathematical Modeling and Scientific Computation*, 9(1):58-67, 1998.
  34. Shah, I. & **Hunter, L.** Visualization Based on the Enzyme Commission Nomenclature. *Pacific Symposium on Biocomputing* 3:142-152 (1998).
  35. Shah, I. & **Hunter, L.** Identification of divergent functions in homologous proteins by induction over conserved modules. *Intelligent Systems for Molecular Biology* 6:157-64 (1998)
  36. Tanabe L, Scherf U, Smith LH, Lee JK, **Hunter L**, Weinstein JN., MedMiner: an Internet text-mining tool for biomedical information, with application to gene expression profiling. *Biotechniques*. 1999 Dec;27(6):1210-4, 1216-7.
  37. Tanabe, L., Rindfleisch, T.C., Weinstein, J.N., **Hunter, L.**, Edgar: Extraction of Drugs, Genes and Relations from the Biomedical Literature, *Pacific Symposium on Biocomputing*, 5:514-525, 2000

38. Shah, I. & **Hunter, L.** Visual Management of Large Scale Data Mining Projects., *Pacific Symp. on Biocomputing*, 5:275-287, 2000
39. **Hunter, L.**, Taylor, R., Leach, S., & Simon, R., GEST: A Gene Expression Search Tool Based on a Novel Bayesian Similarity Metric, *Bioinformatics*. 2001 Jun;17 Suppl 1:S115-S122.
40. Edgerton, ME, Taylor, R., Powell, JI., **Hunter, L.**, Simon, R., and Liu, E., A Bioinformatics Tool to Mine Sequences for Microarray Studies of Mouse Models of Oncogenesis, *Bioinformatics*, 18(5):774-775. 2002
41. Cohen, K.B., Dolbey, A., Acquah-Mensah, G. and **Hunter, L.** Contrast and variability in gene names *Proceedings of the Workshop on Natural Language Processing in the Biomedical Domain*, Philadelphia, July 2002, pp. 14-20 Association for Computational Linguistics.
42. **Hunter, L.** Ontologies for Programs, Not People. *Genome Biology* 2002, 3(6):interactions1002.1-1002
43. Phang, T.L, Neville, M.C., Rudolph, M. and **Hunter, L.** Trajectory clustering: A non-parametric method for grouping gene expression time courses, with applications to mammary development., *Pacific Symposium on Biocomputing* 2003, 8:351-362.
44. Brown, E.B., Dolbey, A., **Hunter, L.** IBM Research and the University of Colorado TREC 2003 Genomics Track. *Proceedings of the Twelfth Text Retrieval Conference (TREC 2003)*:pp. 268-275, National Institute of Standards and Technology.
45. Shenkar, R., Elliott, J.P., Diener, K., Gault, J., Hu, L.J., Cohrs, R.J., Phang, T., **Hunter, L.**, Breeze, R.E., and Awad, I.A., Gene Expression in Human Cerebral Vascular Malformations, *Neurosurgery*, 52(2):465-478 2003
46. Witzmann, F., Li, J., Strother, W. McBride, W., **Hunter, L.**, Crabb, D., Lumeng, L., Li, T.K. Innate Differences in Protein Expression in the Nucleus Accumbens and Hippocampus of Inbred Alcohol-Preferring and -Nonpreferring Rats. *Proteomics* 2003 Jul;3(7):1335-44.
47. Rudolph, M., McManaman, J., **Hunter, L.**, Phang, T, Neville, M Initiation of Lactation in the Murine Mammary Gland: Temporal analysis of a complex biological switch with expression profiling and trajectory clustering. *J Mammary Gland Biol Neoplasia*. 2003 Jul;8(3):287-307
48. Ogren, P.V., Cohen, K.B. , Acquah-Mensah, G.K., Eberlein, J. **Hunter, L.** The Compositional Structure of Gene Ontology Terms *Pacific Symposium on Biocomputing* 2004, 9:214-225
49. **Hunter, L.** Life and Its Molecules: A Brief Introduction, *AI Magazine*, 25(1): 9-22, Spring 2004
50. Hong, M., Kairmpour-Fard, A., Russell, S. and **Hunter, L.**, Integrated Term Weighting, Visualization, and User Interface Development for Bioinformation Retrieval. *AI, Simulation and Planning in Highly Autonomous Systems Conference (AIS 2004)*. Reprinted in *Springer-Verlag Lecture Notes in Computer Science* 3397: 673-682 (2005)

51. Russell, S.A., Old, W., Resing, K.A. and **Hunter, L.** Proteomic Informatics, *International Review of Neurobiology*, 61:129-157, 2004
52. Lu, Z. and **Hunter, L.** GO Molecular Function Terms are Predictive of Subcellular Localization, *Pacific Symposium on Biocomputing* 2005 10:151-161
53. Ogren, P., Cohen, K.B. and **Hunter, L.** Implications of compositionality in the gene ontology for its curation and usage, *Pacific Symposium on Biocomputing* 2005, 10:174-185
54. Kinoshita, S., Cohen K.B., Ogren, P.V., **Hunter, L.** BioCreAtIvE Task1A: Entity Identification with a Stochastic Tagger. *BMC Bioinformatics* 2005, 6(Suppl 1):S4 (24 May 2005).
55. Coors, ME. **Hunter, L.** Evaluation of Genetic Enhancement: Will Human Wisdom Properly Acknowledge the Value of Evolution? *American Journal of Bioethics*, 2005 Summer;5(3):21-2; discussion W4-9.
56. Cohen, KB, Fox, LM, Ogren, PV & **Hunter, L.** Corpus design for biomedical natural language processing. *Proc. Of the ACL-ISMB workshop Linking Biological Literature, Ontologies and Databases: Mining Biological Semantics* pp. 38-45, Association for Computational Linguistics. June 2005
57. Hu, X., Friedman, D., Hill, S., Caprioli, R., Kobilka, B, **Hunter, L.**, Limbird, L. Proteomic Exploration of Pancreatic Islets in Mice Null for the  $\alpha_2A$  adrenergic receptor. *J. Mol. Endocrin.*, 2005 Aug 35(1):73-88.
58. Cohen, KB, Fox, LM., Ogren PV, **Hunter, L.** Empirical data on corpus design and usage in biomedical natural language processing, *Proc. Am. Medical Informatics Assoc.* Pp. 156-160, 2005
59. Caporaso, JG, Baumgartner WA., Cohen KB, Johnson, HL, Paquette J., and **Hunter, L.** Concept recognition and the TREC Genomics tasks. In: *The Fourteenth Text REtrieval Conference Proceedings*, 2005.
60. Lu, Z. Cohen, KB, **Hunter L.** Finding GeneRIFs via Gene Ontology Annotations, *Pacific Symposium on Biocomputing* 2006 11:52-63
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