



*Research Associate and Visiting Assistant Professor of Computer Science*  
 Department of Computer Science August 1995 – July 1996  
 University of Maryland at College Park

*Faculty Research Assistant*  
 Department of Computer Science March 1992 – June 1992  
 University of Maryland at College Park

*Graduate Research Assistant*  
 Systems Research Center August 1988 – March 1992  
 University of Maryland at College Park

*Graduate Research Assistant*  
 Computer Vision Lab January 1987 – June 1988  
 University of Maryland at College Park

*Human Interface Programmer*  
 Academic Hospital of Groningen Summer 1987  
 Groningen, The Netherlands

*Graduate Teaching Assistant*  
 Department of Computer Science Fall 1986  
 University of Maryland at College Park

*Graduate Research Assistant*  
 Institute for Artificial Intelligence June 1986 – January 1987  
 George Washington University, Washington D.C.

*Artificial Intelligence Programmer*  
 Intellitek Inc. Summer 1986  
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*Graduate Teaching Assistant*  
 Department of Computer Science Spring 1986  
 George Washington University, Washington D.C.

*Graduate Research Assistant*  
 Department of Computer Science August 1985 – June 1986  
 George Washington University, Washington D.C.

*Chief Engineer*  
 WOBC Radio Spring 1984  
 Oberlin, Ohio

CURRENT  
 PROFESSIONAL  
 POSITIONS

Editor-in-Chief, *Genetic Programming and Evolvable Machines*, a journal published by Springer

Associate Editor, *ACM Transactions on Evolutionary Learning and Optimization*, a journal published by the Association for Computing Machinery

Member, Editorial Board, *Evolutionary Computation*, a journal published by MIT Press

Member, Executive Board, *ACM SIGEVO*, a special interest group of the Association for Computing Machinery, on Genetic and Evolutionary Computation (formerly the *International Society for Genetic and Evolutionary Computation*)

**Books**

Banzhaf, W., L. Spector, and L. Sheneman, editors. 2019. *Genetic Programming Theory and Practice XVI*. New York: Springer.

Spector, L. 2007 and 2004. *Automatic Quantum Computer Programming: A Genetic Programming Approach*. New York: Springer Science+Business Media, 2007 (softcover). Boston: Kluwer Academic Publishers, 2004 (hardcover).

Deb, K., R. Poli, W. Banzhaf, H-G Beyer, E. Burke, P. Darwen, D. Dasgupta, D. Floreano, J. Foster, M. Harman, O. Holland, P. Lanzi, L. Spector, A. Tettelmanzi, D. Thierens and A. Tyrrell, editors. 2004. *Proceedings of the Genetic and Evolutionary Computation Conference, GECCO-2004*. Lecture Notes in Computer Science, Vol. 3102-3103, Springer-Verlag.

Spector, L., E. Goodman, A. Wu, W.B. Langdon, H.-M. Voigt, M. Gen, S. Sen, M. Dorigo, S. Pezeshk, M. Garzon, and E. Burke, editors. 2001. *Proceedings of the Genetic and Evolutionary Computation Conference, GECCO-2001*. San Francisco, CA: Morgan Kaufmann Publishers.

Whitley, D., D. Goldberg, E. Cantú-Paz, L. Spector, I. Parmee, and H.-G. Beyer, editors. 2000. *Proceedings of the Genetic and Evolutionary Computation Conference, GECCO-2000*. San Francisco, CA: Morgan Kaufmann Publishers.

Spector, L., U.-M. O'Reilly, W. Langdon, and P. Angeline, editors. 1999. *Advances in Genetic Programming, Volume 3*. Cambridge, MA: MIT Press.

**Journal Publications**

Ding, L., and L. Spector. 2023. Multi-Objective Evolutionary Architecture Search for Parameterized Quantum Circuits. In *Entropy*, Vol 25, No. 1: 93.

Spector, L. 2022. Editorial Introduction. In *Genetic Programming and Evolvable Machines*, Vol. 23, No. 1, pp. 1–2.

Helmuth, T., and L. Spector. 2021. Problem-solving benefits of down-sampled lexicase selection. In *Artificial Life*, Vol 27, Issue 3–4, pp. 183–203. [https://doi.org/10.1162/artl\\_a\\_00341](https://doi.org/10.1162/artl_a_00341)

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Spector, L. 2020. Editorial Introduction. In *Genetic Programming and Evolvable Machines*, Vol. 21, No. 1, pp. 1–2.

O'Neill, M., and L. Spector. 2020. Automatic programming: The open issue? In *Genetic Programming and Evolvable Machines*, Vol. 21, pp. 251–262. <https://doi.org/10.1007/s10710-019-09364-2>. Full text at: <https://rdcu.be/bQUA2>

Spector, L. 2019. Editorial Introduction. In *Genetic Programming and Evolvable Machines*, Vol. 20, No. 1, pp. 1–2.

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- Spector, L. 2017. Introduction to the peer commentary special section on “On the Mapping of Genotype to Phenotype in Evolutionary Algorithms” by Peter A. Whigham, Grant Dick, and James Maclaurin. In *Genetic Programming and Evolvable Machines*, Vol. 18, No. 3, pp. 351–352. DOI: 10.1007/s10710-017-9287-y
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- DelRosso, N. V., S. Hews, L. Spector, and N. D. Derr. 2017. A Molecular Circuit Regenerator to Implement Iterative Strand Displacement Operations. In *Angewandte Chemie International Edition*, DOI: <https://doi.org/10.1002/anie.201610890>.
- Spector, L. 2017. Editorial Introduction. In *Genetic Programming and Evolvable Machines*, Vol. 18, No. 1, pp. 1–2.
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- Spector, L. 2016. Editorial Introduction. In *Genetic Programming and Evolvable Machines*, Vol. 17, No. 1, pp. 1–2.

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- Helmuth, T., L. Spector, and J. Matheson. 2014. Solving Uncompromising Problems with Lexicase Selection. In *IEEE Transactions on Evolutionary Computation*. DOI: 10.1109/TEVC.2014.2362729.
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- McCaffrey, T., and L. Spector. 2012. Behind every innovative solution lies an obscure feature. In *Knowledge Management & E-Learning: An International Journal*, Vol. 4, No. 2, pp. 146–156.
- Spector, L. 2012. Editorial Introduction. In *Genetic Programming and Evolvable Machines*, Vol. 13, No. 1, pp. 1–2.
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- Niekum, S., A. Barto, and L. Spector. 2010. Genetic Programming for Reward Function Search. In *IEEE Transactions on Autonomous Mental Development*, Vol. 2, No. 2, pp. 83–90.
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- Spector, L., J. Klein, and K. Harrington. 2005. Selection Songs: Evolutionary Music Computation. In *YLEM Journal*, Vol. 25, No. 6 & 8, pp. 24–26.
- Spector, L., J. Klein, C. Perry, and M. Feinstein. 2005. Emergence of Collective Behavior in Evolving Populations of Flying Agents. In *Genetic Programming and Evolvable Machines*, Vol. 6, No. 1, pp. 111–125.
- Spector, L. 2002. Book Review: The Quest for the Quantum Computer, by J. Brown. In *Genetic Programming and Evolvable Machines*, Vol. 3, No. 4, pp. 391–393.
- Spector, L., and A. Robinson. 2002. Genetic Programming and Autoconstructive Evolution with the Push Programming Language. In *Genetic Programming and Evolvable Machines*, Vol. 3, No. 1, pp. 7–40.
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- Grafman, J., A. Sirigu, L. Spector, and J. Hendler. 1993. Damage to the prefrontal cortex leads to decomposition of structured event complexes. In *The Journal of Head Trauma Rehabilitation*, Volume 8, Number 1, Aspen Publishers, Inc., pp. 73–87.

Spector, L. and J. Hendler. 1992. Planning and Reacting Across Supervenient Levels of Representation. In *International Journal of Intelligent and Cooperative Information Systems*, Volume 1, Numbers 3 & 4, pp. 411–449.

Spector, L. and J. Hendler. 1989. Book Review: Minimal Rationality, by C. Cherniak. In *Artificial Intelligence*, Volume 39, Number 1.

### ***Conference and Workshop Papers***

Ding, L., E. Pantridge, and L. Spector. 2023. Probabilistic Lexicase Selection. In *Proceedings of the Genetic and Evolutionary Computation Conference (GECCO '23)*. Association for Computing Machinery, New York, NY, USA, 10731081.

Boldi, R., and L. Spector. 2023. Can the Problem-Solving Benefits of Quality Diversity be Obtained Without Explicit Diversity Maintenance? In *Genetic and Evolutionary Computation Conference Companion (GECCO-2023 Companion)*. Association for Computing Machinery, New York, NY, USA, 21522156. <https://doi.org/10.1145/3583133.3596336>

Boldi, R., T. Helmuth, and L. Spector. 2022. The environmental discontinuity hypothesis for down-sampled lexicase selection. In the *Why it didn't work-shop at ALIFE 2022: The 2022 Conference on Artificial Life*. Posted at <https://arxiv.org/pdf/2205.15931.pdf>

Pantridge, E., T. Helmuth, and L. Spector. 2022. Functional code building genetic programming. In *Proceedings of the Genetic and Evolutionary Computation Conference (GECCO '22)*, pp. 1000–1008. Published by the Association for Computing Machinery.

Ding, L., and L. Spector. 2022. Evolutionary quantum architecture search for parametrized quantum circuits. In *GECCO '22: Proceedings of the Genetic and Evolutionary Computation Conference Companion*, pp. 2190–2195. Published by the Association for Computing Machinery.

Ding, L., R. Boldi, T. Helmuth, and L. Spector. 2022. Lexicase selection at scale. In *GECCO '22: Proceedings of the Genetic and Evolutionary Computation Conference Companion*, pp. 2054–2062. Published by the Association for Computing Machinery.

Ding, L., and L. Spector. 2022. Optimizing Neural Networks with Gradient Lexicase Selection. In *The Tenth International Conference on Learning Representations (ICLR 2022)*. Published at openreview.net: [https://openreview.net/pdf?id=J\\_2xNmVcY4](https://openreview.net/pdf?id=J_2xNmVcY4)

Ding, L., and L. Spector. 2021. Evolving neural selection with adaptive regularization. In *Proceedings of GECCO 2021 Companion*, pp. 1717-1725. Genetic and Evolutionary Computation Conference (GECCO '22). Published by the Association for Computing Machinery.

Helmuth, T., E. Pantridge, G. Woolson, and L. Spector. 2020. Genetic Source Sensitivity and Transfer Learning in Genetic Programming. In *Artificial Life Conference Proceedings*, pp. 303–311. MIT Press.

Helmuth, T., and Spector, L. 2020. Explaining and Exploiting the Advantages of Down-sampled Lexicase Selection. In *Artificial Life Conference Proceedings*, pp. 341-349. MIT Press.

Pantridge, E., and L. Spector. 2020. Code Building Genetic Programming. In *Proceedings of the Genetic and Evolutionary Computation Conference (GECCO '20)*, pp. 994–1002. Published by the Association for Computing Machinery.

Saini, A. K., and L. Spector. 2020. Effect of Parent Selection Methods on Modularity. In *EuroGP 2020: Proceedings of the 23rd European Conference on Genetic Programming*, pp. 184-194. Springer Verlag.

**Winner, Best Paper Award**

Aenugu, S., and Spector, L. 2019. Lexicase selection in learning classifier systems. In *Proceedings of the Genetic and Evolutionary Computation Conference (GECCO '19)*, pp. 356-364. Published by the Association for Computing Machinery.

Helmuth, T., Pantridge, E., and Spector, L. 2019. Lexicase selection of specialists. In *Proceedings of the Genetic and Evolutionary Computation Conference (GECCO '19)*, pp. 1030-1038. Published by the Association for Computing Machinery.

**Winner, Best Paper Award, Genetic Programming Track**

Saini, A. K., and Spector, L. 2019. Modularity metrics for genetic programming. In *Proceedings of GECCO 2019 Companion*, pp. 2056-2059. Genetic and Evolutionary Computation Conference (GECCO '19). Published by the Association for Computing Machinery.

Helmuth, T., N. F. McPhee, and L. Spector. 2018. Program Synthesis using Uniform Mutation by Addition and Deletion. In *Proceedings of the Genetic and Evolutionary Computation Conference (GECCO '18)*. Published by the Association for Computing Machinery.

**Winner, Best Paper Award, Genetic Programming Track**

La Cava, W., S. Silva, K. Danai, L. Vanneschi, J. H. Moore, and L. Spector. 2018. A multidimensional genetic programming approach for identifying epistatic gene interactions. In *Proceedings of GECCO 18 Companion*. Genetic and Evolutionary Computation Conference, Kyoto, Japan. Published by the Association for Computing Machinery.

Pantridge, E. R., T. Helmuth, N. F. McPhee, and L. Spector. 2018. Specialization and Elitism in Lexicase and Tournament Selection. In *Proceedings of GECCO 18 Companion*. Genetic and Evolutionary Computation Conference, Kyoto, Japan. Published by the Association for Computing Machinery.

Pantridge, E. R., and L. Spector. 2018. Plushi: An Embeddable, Language Agnostic, Push Interpreter. In *Proceedings of GECCO 18 Companion*. Genetic and Evolutionary Computation Conference, Kyoto, Japan. Published by the Association for Computing Machinery.

Helmuth, T., N. F. McPhee, E. Pantridge and L. Spector. 2017. Improving generalization of evolved programs through automatic simplification. In *Proceedings of the Genetic and Evolutionary Computation Conference (GECCO '17)*. ACM, New York, NY, USA, 937-944. DOI: <https://doi.org/10.1145/3071178.3071330>

**Nominated, Best Paper Award, Genetic Programming Track**

Pantridge, E., T. Helmuth, N. F. McPhee, L. Spector. 2017. On the Difficulty of Benchmarking Inductive Program Synthesis Methods. In *Proceedings of GECCO 17 Companion*, Berlin, Germany. DOI: <http://dx.doi.org/10.1145/3067695.3082533>

Spector, L. and E. Moscovici. 2017. Recent Developments in Autoconstructive Evolution. Extended abstract for invited presentation. In *Proceedings of GECCO 17 Companion*, Berlin, Germany. DOI: <http://dx.doi.org/10.1145/3067695.3082058>

Pantridge, E. and L. Spector. 2017. PyshGP: PushGP in Python. In *Proceedings of GECCO 17 Companion*, Berlin, Germany. DOI: <http://dx.doi.org/10.1145/3067695.3082468>

La Cava, W., S. Silva, L. Vanneschi, L. Spector, and J. Moore. 2017. Genetic Programming Representations for Multi-dimensional Feature Learning in Biomedical Classification. In *Applications of Evolutionary Computation. EvoApplications 2017*. Lecture Notes in Computer Science, Vol. 10199. Springer.

Helmuth, T., N. F. McPhee, and L. Spector. 2016. The Impact of Hyperselection on Lexicase Selection. In *Proceedings of the 2016 Genetic and Evolutionary Computation Conference, GECCO'16*. ACM Press. pp. 717–724.

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La Cava, W., L. Spector, and K. Danai. 2016. Epsilon-lexicase Selection for Regression. In *Proceedings of the 2016 Genetic and Evolutionary Computation Conference, GECCO'16*. ACM Press. pp. 741–748.

Pantridge, E., and L. Spector. 2016. Evolution of Layer Based Neural Networks: Preliminary Report. In *Companion Publication of the 2016 Genetic and Evolutionary Computation Conference, GECCO'16 Companion*. ACM Press. pp. 1015–1022..

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McPhee, N. F., M. M. Casale, M. Finzel, T. Helmuth, and L. Spector. 2016. Visualizing Genetic Programming Ancestries. In *Companion Publication of the 2016 Genetic and Evolutionary Computation Conference, GECCO'16 Companion*. ACM Press. pp. 1419–1426.

Spector, L.. Work in Progress on Autoconstructive Evolution (Extended Abstract). 2016. In *Proceedings of the 6th International Conference on Metaheuristics and nature inspired computing, META'2016*. Marrakech, Morocco.

La Cava, W., K. Danai, L. Spector, P. Fleming, M. A. Lackner, and A. Wright. 2015 Automatic Identification of Closed-loop Wind Turbine Dynamics via Genetic Programming. In *Proceedings of the ASME 2015 Dynamic Systems and Control Conference*.

La Cava, W., T. Helmuth, L. Spector, and K. Danai. 2015. Genetic Programming with Epigenetic Local Search. In *Proceedings of the 2015 Genetic and Evolutionary Computation Conference, GECCO'15*. ACM Press. pp. 1055–1062.

**Nominated, Best Paper Award, Genetic Programming Track.**

Helmuth, T., and L. Spector. 2015. General Program Synthesis Benchmark Suite. In *Proceedings of the 2015 Genetic and Evolutionary Computation Conference, GECCO'15*. ACM Press. pp. 1039–1046.

Liskowski, P., K. Krawiec, T. Helmuth, and L. Spector. 2015. Comparison of Semantic-aware Selection Methods in Genetic Programming. In *Companion Publication of the 2015 Genetic and Evolutionary Computation Conference, GECCO'15 Companion*. ACM Press. pp. 1301–1307.

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Stout, A., and L. Spector. 2005. Validation of Evolutionary Activity Metrics for Long-Term Evolutionary Dynamics. In *Proceedings of the Genetic and Evolutionary Computation Conference (GECCO-2005)*, pp. 137–142. Springer-Verlag.

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### ***Posters and Poster Papers***

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### ***Additional Scientific Publications***

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### ***Newspaper Op-Ed***

And now, digital evolution. In *The Boston Globe*, August 29, 2005.

### ***Letters to the Editor***

Letter to the editor, *The Daily Hampshire Gazette*, regarding local taxes, May 30, 2009.

Letter to the editor, *The Daily Hampshire Gazette*, regarding funding for public education, May 19, 2006.

Letter to the editor, *New York Times*, regarding warrantless surveillance, March 10, 2006.

Letter to the editor, *Scientific American*, regarding nanobots, January, 2002.

Letter to the editor, *Circuits* section, *New York Times*, regarding robotic pets, May 11, 2000.

Letter to the editor, *IEEE Intelligent Systems*, regarding quantum computing, September/October, 1999.

### PRESENTATIONS

*(in addition to those for conference/workshop papers and posters listed above)*

ChatGPT in Education: Boon, Bane and Beyond. Panel discussion with Kristina Reardon and Christopher Grobe, facilitated by Jaya Kannan and Riley Caldwell-O'Keefe. Academic Technology Services and Center for Teaching and Learning, Amherst College. February 20, 2023.

Honor All the Things: A Lexicase Selection Manifesto. Keynote presentation. The 10th International Workshop on Numerical and Evolutionary Optimization (NEO X). November 9, 2022.

Honor All the Things: The case against aggregating objectives in AI and maybe everything else. Faculty Colloquium. Amherst College, September 23, 2022.

A Conversation with John Koza. Interview and panel discussion with John Koza, Erik Goodman, Wolfgang Banzhaf, and Kalyanmoy Deb. *Genetic and Evolutionary Computation Conference (GECCO)*, July, 2022.

Push. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July, 2021. Slides published in *GECCO '21 Companion*, by the Association for Computing Machinery.

Information Theory. *Science on Screen* presentation in conjunction with a screening of *The Bit Player*, a film about Claude Shannon, at Amherst Cinema, March 23, 2021.

Genetic Programming with Autoconstructive Evolution. Guest lecture in Thomas Helmuth's *Topics in Computer Science II* course. Hamilton College, November 11, 2020.

Push. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July, 2020. Slides

published in *GECCO '20 Companion*, by the Association for Computing Machinery.

Evolutionary Computation. Computer Science Seminar, Union College, March 6, 2020.

Evolutionary Computation. Computer Science Colloquium. Amherst College, November 4, 2019.

Push. With N. F. McPhee. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July, 2019. Slides published in *GECCO '19 Companion*, by the Association for Computing Machinery.

Expressive Genetic Programming: Concepts and Applications. With N. F. McPhee. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July, 2018. Slides published in *GECCO '18 Companion*, by the Association for Computing Machinery.

Life and Death, Artificial and Real. Guest lecture in Daniel Altshuler's and Pamela Stone's *Life and Death* course. Hampshire College, April 5, 2018.

Genetic Programming with Autoconstructive Evolution. MIT Computational Cognitive Science Group. November 17, 2017.

Evolving evolution, in computers, to solve some of the world's hardest problems. School of Cognitive Science, Hampshire College, September 27, 2017.

Expressive Genetic Programming: Concepts and Applications. With N. F. McPhee. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July, 2017. Slides published in *GECCO '17 Companion*, <http://dx.doi.org/10.1145/3067695.3067699>

Expressive Genetic Programming: Concepts and Applications. With N. F. McPhee. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July, 2016.

Artificial Intelligence, Evolutionary Computation, and Autoconstructive Evolution. Guest lecture for the Honors Colloquium class visiting from Holyoke Community College, at Hampshire College, April 8, 2016.

Autoconstructive Evolution. School of Cognitive Science, Hampshire College, March 2, 2016.

Genetic Programming in Clojure. Presentation at Clojure/Conj, Philadelphia, PA, November 17, 2015.

Automatic Programming via Evolution. Invited presentation, *Complex Systems Digital Campus 15: World e-Conference*, organized by the Complex Systems Digital Campus (CS-DC), a UNESCO UniTwin, September 30, 2015.

Automatic Programming via Evolution. School of Cognitive Science, Hampshire College, September 30, 2015.

The Future of AI. Interview, *The Technoskeptic* podcast ([thetechnoskeptic.com](http://thetechnoskeptic.com)), July 15, 2015.

Expressive Genetic Programming. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July, 2015.

Solving Uncompromising Problems with Lexicase Selection. Presentation for the "Hot Off the Press" track, *Genetic and Evolutionary Computation Conference (GECCO)*, July, 2015.

The possibility of developing an artificial brain, and what the development of artificial people means both for them and for us. *Science on Screen* presentation in conjunction with a screening of *Blade Runner* at Amherst Cinema, May 6, 2015.

The Future of Genetic Programming. Guest lecture. Mount Holyoke College, April 15, 2015.

Evolution of Expressive Programs: Principles, Products, and Prospects. Keynote presentation, BEACON Congress, BEACON (An NSF Center for the Study of Evolution in Action), Michigan State University, August 18, 2014.

Expressive Program Evolution. Invited presentation, Computer Science Department and Molecular and Cellular Biology Program, Dartmouth College, July 28, 2014.

Expressive Genetic Programming. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July, 2014.

Steps toward the evolution of arbitrary software. Presentation at *Genetic Programming Theory and Practice Workshop*, with Thomas Helmuth, University of Michigan, Ann Arbor, May 9, 2014.

The Calculator Problem and the Evolutionary Synthesis of Arbitrary Software. Invited presentation, *The 28th CREST Open Workshop: Genetic Programming for Software Engineering*, University College London, October 14, 2013.

Quantum Computing. Guest lecture in Jaime Davila's *Privacy in the Age of the Internet* class. Hampshire College, March 4, 2014.

Expressive Genetic Programming. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July, 2013.

Expressive Genetic Programming. Tutorial, *12th International Conference on Parallel Problem Solving From Nature (PPSN)*, September, 2012.

Expressive Genetic Programming. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July, 2012.

The Evolution of Identity and Modularity in Nature and Computation. Invited presentation, Neuroscience Department, Oberlin College, March 16, 2012.

3D Models. Guest lecture for Keith Downing's modeling seminar, Oberlin College, March 16, 2012.

Genomes as Reactive Systems: A Computational Perspective. Guest lecture in *Frontiers in Biomathematics*. Smith College, March 14, 2012.

Biologically-Inspired Evolution of Computer Programs: Tag-based Modularity in Genetic Programming. Guest lecture in Hava Siegelmann's *Computational Social Neuroscience* seminar. University of Massachusetts, Amherst, February 29, 2012.

Other Minds Produced by Computational Evolution. Two guest lectures in Laura Sizer's *Other Minds* course, Hampshire College, October 26 and 31, 2011.

Evolving Quantum Computer Algorithms. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July, 2011.

Biologically-Inspired Evolution of Computer Programs: Tag-based Modularity in Genetic

Programming. Guest lecture in Hava Siegelmann's *Introduction to Modern Computational Neuroscience* seminar. University of Massachusetts, Amherst, April 22, 2011.

Biologically-Inspired Evolution of Computer Programs: Tag-based Modularity in Genetic Programming. School of Cognitive Science, Hampshire College, March 2, 2011.

Other Minds Produced by Computational Evolution. Two guest lectures in Laura Sizer's *Other Minds* course, Hampshire College, November 15 and 17, 2010.

Expressive Languages for Evolved Programs and Autoconstructive Evolution. Invited presentation, CSE Department and BEACON Center, Michigan State University, November 12, 2010.

Evolving the Future of Mathematics. "Prime Time" presentation for *Hampshire College Summer Studies in Mathematics*, Hampshire College, August 12, 2010.

Evolution of Quantum Algorithms. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July, 2010.

Hampshire on the Technological Cutting Edge and Computational Intelligence at Hampshire. Presentations at the *Hampshire College 40th Anniversary* celebration, June, 2010.

From Bits to Brains that Make and Appreciate Art. *Art on the Brain* conference, Mount Holyoke College, June, 2010.

Computer Science, Cognitive Science, and Artificial Life at Hampshire. Accepted student's day presentation, Hampshire College, April, 2010.

Expressive Languages for Evolved Programs. Machine Learning and Friends Lunch presentation. University of Massachusetts, Amherst, November 12, 2009.

Evolving Quantum Computer Algorithms. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July, 2009.

Trivial Geography and Historically-Assessed Hardness: Two simple techniques for enhancing the problem-solving power of genetic programming. University of Tokyo, Japan, June 24, 2009.

Quantum Computing and Evolutionary Computation. Tutorial, *World Summit on Genetic and Evolutionary Computation*, Shanghai, China, June 13, 2009.

Comments on Douglas Saddy's "Perceiving and Processing Recursion in Formal Grammars." *Recursion: Structural Complexity in Language and Cognition* conference, University of Massachusetts, Amherst, May 28, 2009.

The Computational Creativity Curriculum. National Science Foundation CreativeIT Principal Investigators meeting, January 15, 2009.

Past and Future Origins of Artificial Life. School of Cognitive Science, Hampshire College, November 19, 2008.

Examples for the Aesthetics of Data Workshop. *Aesthetics of Data and its Analysis* workshop, Kahn Liberal Arts Institute, Smith College, October 18, 2008.

Darwin Machines for Science and Art. Hampshire College event for trustees, alumni and prospective students, September 25, 2008.

Genetic Programming for Finite Algebras. “Prime Time” presentation for *Hampshire College Summer Studies in Mathematics*, Hampshire College, July 29, 2008.

Quantum Computing. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, June, 2008.

Climate Change and Complex Adaptive Systems. *Focus Hampshire*, a climate change teach-in, Hampshire College, March 7, 2008.

Evolution, the Programmer and Mathematician. School of Cognitive Science, Hampshire College, February 20, 2008.

Advanced Computing in a Complex World. Vermont Advanced Computing Center, University of Vermont, January, 2008.

The Computational Creativity Curriculum. School of Cognitive Science, Hampshire College, October, 2007.

Quantum Computing. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, June, 2007.

Intelligence Evolving. Invited presentation. *Oberlin Club of Western New England*, Northampton, Massachusetts, May 6, 2007.

Evolutionary Computation for Science, Engineering and Art. Invited presentation. *School of Science & Engineering Colloquium Series*, State University of New York at New Paltz, April 26, 2007.

Algorithmic Art. Invited presentation. Hampshire College course on *Topics in Computer Graphic Animation Arts*, taught by Eric Wilson, March 13, 2005.

Strange Bits: Quantum Computing and the Search for New Quantum Algorithms. Invited Presentation. *Sigma Xi* Scientific Research Society, Swarthmore College Chapter, January 30, 2007.

Cooperation and Computational Evolution. *The Grey Thumb Society*, Cambridge, MA, December 4, 2006.

Division Blocks. School of Cognitive Science, Hampshire College, October 12, 2006.

Quantum Computing. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, June, 2006.

Evolution of Irreducible Complexity by Natural Selection. *Evolution, Science, and Intelligent Design: A Panel Discussion*, Hampshire College, February 8, 2006.

Guest presentations on topics in science and math at Bridge Street Elementary School, Northampton MA. Topics included robotics, physics of sound, fractals, logo programming, binary, light and spectroscopy, planetary orbits, the Krypto math game, insects and swarm intelligence, digital microscopy, and the fourth dimension.

Algorithmic Arts. *Art and Technology Retreat*, Hampshire College, January 27, 2006.

The Chomsky Hierarchy. Invited presentation. Hampshire College course on *Human Nature*,

*Language, and Politics: Noam Chomsky and His Critics*, taught by Ernie Alleva and Steve Weisler, December 5, 2005.

Quantum Computing. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, June, 2005.

The Evolution of Arbitrary Computational Processes. Invited presentation. Department of Computer Science, University of Maryland, College Park, March 7, 2005.

Automated Invention by Means of Genetic Programming. Tutorial, with John Koza, *Nineteenth National Conference on Artificial Intelligence, AAAI-04*, July 25, 2004.

Quantum Computing. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July 13, 2003.

Quantum Computing for Genetic Programmers. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July 9, 2002.

Quantum Computing and Artificial Intelligence. Chevron TechNet Advanced Information-Based Modeling seminar series. November 12, 1999.

Quantum Computing and AI. Invited Presentation, *Sixteenth National Conference on Artificial Intelligence, AAAI-99*, 1999.

Quantum Computation. Tutorial, *Genetic and Evolutionary Computation Conference (GECCO)*, July 14, 1999.

Genetic Programming of Intelligent Agents and Artists. Invited lecture. Swarthmore College Cognitive Science Colloquium Series. 1996.

Genetic Programming of Cognitive Models. Invited presentation. Cognitive Neuroscience Unit, National Institute of Neurological Disorders and Stroke, National Institutes of Health. 1996.

Automatic Generation of Planning Systems. Georgia Institute of Technology. 1996.

Artificial Intelligence as the Liberal Arts of Computer Science. Cognitive Science Brown Bag Lunch Presentation, Georgia Institute of Technology. 1996.

Exploring the Internet. Science Education Partnership , Hampshire College. 1994.

What Computers Can't Do. Guest lecture. Smith College. 1993.

Representations and Processes in Human Prefrontal Cortex: Convergence of Cognitive Neuroscience, Cognitive Science, and Artificial Intelligence Research. Panel presentation. Thirteenth Annual Conference of the Cognitive Science Society. 1991.

PARKA: Knowledge Representation on the Connection Machine. Panel presentation. Workshop on Term Subsumption Languages in Knowledge Representation. 1989.

#### GRANTS AND AWARDS

National Science Foundation, Division Of Computer and Network Systems. MRI: Acquisition of High Performance Computing System for Interdisciplinary Research and Teaching. PIs: A. Wagaman and L. Spector. \$500,000. 2021–2024.

Best Paper Award, 23rd European Conference on Genetic Programming (EuroGP 2020).

Best Paper Award, Genetic and Evolutionary Computation Conference (GECCO-2019), Genetic Programming Track.

Best Paper Award, Genetic and Evolutionary Computation Conference (GECCO-2018), Genetic Programming Track.

National Science Foundation, Division of Information and Intelligent Systems, Directorate for Computer and Information Science and Engineering, Robust Intelligence program. RI: Small: RUI: Synthesis of Robust Artificial Systems by Adaptive Genetic Programming. PI: L. Spector. \$418,897. 2016–2019.

Google, CS Engagement Award. Programming for Science. \$5,000. 2015.

National Science Foundation, Division of Computing and Communication Foundations. Human-Competitive Evolutionary Computation. Co-Principal Investigators: L. Spector and M. Sipper. \$42,000. 2013–2016.

National Science Foundation, Division of Biological Infrastructure, Interdisciplinary Training in Biology and Mathematics. UBM-Institutional-Collaborative Research: Four College Biomath Consortium. Co-Principal Investigators: L. Spector and S. Hews. \$181,159. 2011–2016.

National Science Foundation, Division of Information and Intelligent Systems. RUI: Evolution of Robustly Intelligent Computational Systems. \$423,288. 2010–2015.

Sherman Fairchild Foundation, Design, Art, and Technology: Innovation Synergy. Grant to Hampshire College; Ellen Donkin and Lee Spector, Co-Directors. \$300,000. 2009–2012.

Gold medal, GECCO-2008 Human-Competitive Results competition. With David M. Clark, Ian Lindsay, Bradford Barr, and Jon Klein. \$5,000. 2008.

National Science Foundation, CreativeIT program. The Computational Creativity Curriculum. Co-Principal Investigators: J. Davila, C. Perry. \$49,641. 2008–2009.

Elected *Fellow*, International Society for Genetic and Evolutionary Computation. 2004.

Gold medal, GECCO-2004 Human-Competitive Results competition. With Herbert J. Bernstein and Howard Barnum. \$1,500. 2004.

National Science Foundation, Director's Award for Distinguished Teaching Scholars. Open-Ended Evolution in Visually Rich Virtual Worlds: Implementation, Analysis, and Use in Undergraduate Education. \$300,000. 2003–2007.

Best Paper Award, Genetic and Evolutionary Computation Conference (GECCO-2003), AAAA Track (A-Life, Adaptive Behavior, Agents, and Ant Colony Optimization).

National Science Foundation, Major Research Instrumentation program and Research in Undergraduate Institutions program. Acquisition of Instrumentation for Research in Genetic Programming, Quantum Computation, and Distributed Systems. \$99,751. 2002–2005.

Defense Advanced Research Projects Agency (DARPA) program on Agent Based Computing. Multi-type, Self-adaptive Genetic Programming for Complex Applications. \$295,936. 2001–2004.

Hampshire College support for the Institute for Computational Intelligence.

MacArthur Chair at Hampshire College. \$45,000. 1997–2000.

National Science Foundation, Learning and Intelligent Systems Program. Inquiry-Based Science Education: Cognitive Measures and Systems Support. Co-Principal Investigators: N. Stillings, L. Spector, S. Weisler, L. Winship, and B. Woolf. \$1,100,000. 1997.

Lemelson National Program in Invention, Innovation and Creativity. Applications of Evolved Complex Dynamic Systems. With Mark Feinstein. \$3,000. 1997.

Lemelson National Program in Invention, Innovation and Creativity. Enhancing the human/computer interface: video-based movement analysis. With Slavoljub Milekic and Mark Feinstein. \$6,200. 1996.

Hewlett-Mellon Faculty Development Grant. Intelligent Real-time Music Processing. \$700. 1996.

Hewlett-Mellon Faculty Development Grant. Evolutionary Computation and the Arts. \$1,500. 1995.

Lemelson National Program in Invention, Innovation and Creativity. MIDI/Motion Device, Demonstration and Enhancement. \$2,500. 1995.

Hewlett-Mellon Faculty Development Grant. The Virtual Student Union. \$1,500. 1994.

Lemelson National Program in Invention, Innovation and Creativity. Travel grant for AAAI-94. \$1,000. 1994.

Lemelson National Program in Invention, Innovation and Creativity. Grant for the establishment of the Creative Cognition Laboratory. \$15,000. 1993.

## SERVICE

### ***Professional Conference Program Committees***

38th AAAI Conference on Artificial Intelligence, AAAI-2024

*Senior program committee*

Genetic and Evolutionary Computation Conference, GECCO-2023

Workshop on Quantum Optimization at GECCO-2023

European Conference on Genetic Programming, EuroGP-2023

Genetic and Evolutionary Computation Conference, GECCO-2022

Workshop on Quantum Optimization at GECCO-2022

European Conference on Genetic Programming, EuroGP-2022

36th AAAI Conference on Artificial Intelligence, AAAI-2022

*Senior program committee*

Genetic and Evolutionary Computation Conference, GECCO-2021

35th AAAI Conference on Artificial Intelligence, AAAI-2021

*Senior program committee*

European Conference on Genetic Programming, EuroGP-2021

Artificial Life Conference, ALife2020

Genetic and Evolutionary Computation Conference, GECCO-2020

European Conference on Genetic Programming, EuroGP-2020

Genetic and Evolutionary Computation Conference, GECCO-2019

European Conference on Genetic Programming, EuroGP-2019

Genetic and Evolutionary Computation Conference, GECCO-2018

European Conference on Genetic Programming, EuroGP-2018

Genetic and Evolutionary Computation Conference, GECCO-2017

European Conference on Genetic Programming, EuroGP-2017

Genetic and Evolutionary Computation Conference, GECCO-2016

Genetic and Evolutionary Computation Conference, GECCO-2015  
 European Conference on Genetic Programming, EuroGP-2015  
 The 6th annual Symposium on Search-Based Software Engineering, SSBSE-2014  
 The 14th International Conference on the Synthesis and Simulation of Living Systems, ALIFE-14  
 Genetic and Evolutionary Computation Conference, GECCO-2014  
 European Conference on Genetic Programming, EuroGP-2014  
 Genetic and Evolutionary Computation Conference, GECCO-2013  
 European Conference on Genetic Programming, EuroGP-2013  
 Genetic and Evolutionary Computation Conference, GECCO-2012  
 European Conference on Genetic Programming, EuroGP-2012  
 Genetic and Evolutionary Computation Conference, GECCO-2011:  
     *Co-chair, genetic programming track*  
 European Conference on Genetic Programming, EuroGP-2011  
 Genetic and Evolutionary Computation Conference, GECCO-2008  
 Genetic and Evolutionary Computation Conference, GECCO-2006  
 Fourth European Workshop on Evolutionary Music and Art, EvoMUSART-2006  
 IEEE Computational Intelligence and Games, CIG-2005  
 Third European Workshop on Evolutionary Music and Art, EvoMUSART-2005  
 AAI 2004 Fall Symposium on Artificial Multi-Agent Learning Genetic and Evolutionary Computation Conference, GECCO-2004:  
     *Chair, genetic programming track*  
     *Judge, TinyGP competition*  
 European Conference on Artificial Intelligence, ECAI 2004  
 Genetic and Evolutionary Computation Conference, GECCO-2003  
 Genetic and Evolutionary Computation Conference, GECCO-2001:  
     *Proceedings Editor-in-Chief*  
 Genetic and Evolutionary Computation Conference, GECCO-2000:  
     *Chair, genetic programming and evolvable hardware tracks*  
 Sixteenth National Conference on Artificial Intelligence, AAAI-99:  
     *Senior program committee*  
 Fifteenth National Conference on Artificial Intelligence, AAAI-98  
 Third International Conference on Genetic Programming, GP-98  
 Thirteenth National Conference on Artificial Intelligence, AAAI-96  
 First International Conference on Genetic Programming, GP-96  
 Genetic Programming Track, IEEE Intl. Conference on Evolutionary Computation, ICEC-96  
 Florida Artificial Intelligence Research Society (FLAIRS) conference

### ***Additional Reviewing***

*Adaptive Behavior* (journal)  
*Advances in Genetic Programming 2* (MIT Press)  
*Artificial Intelligence* (journal)  
*Artificial Life* (journal)  
*BioSystems* (journal)  
*Computational Intelligence* (journal)  
*Design Automation Conference, 2004, Ph.D. Forum*  
*Evolutionary Computation* (journal)  
*Genetic Programming and Evolvable Machines* (journal)  
*Genetic Programming: Theory and Practice* (Kluwer Academic Publishers)  
*IEEE Computational Intelligence Magazine*  
*IEEE Transactions on Evolutionary Computation* (journal)  
*IEEE Transactions on Systems, Man, and Cybernetics—Part C: Applications and Reviews* (journal)  
*Journal of Experimental and Theoretical Artificial Intelligence* (journal)  
 The Marsden Fund (The Royal Society of New Zealand)

National Science Centre Poland  
 National Science Foundation Distinguished Teaching Scholars Panel  
 National Science Foundation Instrumentation and Laboratory Improvement Review Panel  
 National Science Foundation Robust Intelligence Panel  
 National Science Foundation Graduate Research Fellowship Program  
 Natural Sciences and Engineering Research Council of Canada  
 Nederlandse Organisatie voor Wetenschappelijk Onderzoek (The Netherlands)  
 The Netherlands Organisation for Scientific Research (NWO), council for physical sciences  
*Nature Reviews Genetics* (journal)  
*Physical Review Letters* (journal)  
*PLOS Computational Biology* (journal)  
*Royal Society Interface* (journal)  
 Science Foundation Ireland  
 Sherman Fairchild Foundation (Arts and Technology program site visits)  
*Trends in Ecology and Evolution* (journal)  
 UK Engineering and Physical Sciences Research Council

### ***Additional Service***

Amherst College Faculty Committee on Research Awards  
 Hampshire College Strategic Plan Implementation Planning Group  
 Hampshire College Design, Art and Technology Program (co-director)  
 Hampshire College Governance Task Force  
 Hampshire College Creativity Center Steering Committee  
 Five College Logic Certificate Program (Hampshire representative)  
 Five College Biomathematics Consortium Steering Committee  
 Hampshire College Making of the College 2.0 Oversight Committee (co-chair)  
 Hampshire College Wabash Study Task Force  
 Faculty representative to the Hampshire College Board of Trustees  
 Hampshire College Educational Policy Committee  
 Hampshire College Campus Committee on Faculty Reappointments and Promotions  
 Hampshire College Information Technology Steering Committee  
 Hampshire College Faculty Compensation Committee  
 Hampshire College Executive Committee of the Faculty  
 Hampshire College Task force to examine the granting of graduate degrees (chair)  
 Hampshire College Search Committee Chair, Asst. Prof. Media Arts and Sciences  
 Hampshire College Search Committee Chair, Prof. Integrated Science and Humanities  
 Hampshire College Search Committee Chair, Asst. Prof. Computer Science  
 Hampshire College Search Committee Chair, Visiting Prof. Computer Science (several instances)  
 Hampshire College Search Committee Chair, Visiting Prof. Cognitive Science  
 Hampshire College Search Committee Chair, Asst. Prof. Computer Science & Game Design  
 Hampshire College Search Committee Chair, Administrative Assistant for Cognitive Science  
 Hampshire College Search Committee member (several instances)  
 Science Fair judge, Northampton MA Public Schools  
 Science and math enrichment activity presenter, Northampton MA Public Schools  
 Graduate Student Workshop judge, Genetic and Evolutionary Computation Conference  
 Human-competitive Results Competition judge (several occasions), Genetic and Evolutionary Computation Conference

GRADUATE  
 STUDENT  
 COMMITTEE  
 MEMBERSHIPS OR  
 ADVISORSHIPS

Li Ding (Ph.D. student, U. Massachusetts)  
 Esteban Ricalde González (Ph.D. student, Memorial University of Newfoundland)  
 Kyle Harrington (Ph.D. student, Brandeis University)

Thomas Helmuth (Ph.D. student, U. Massachusetts)  
Karthik Kannappan (M.S. student, U. Massachusetts)  
Brian Kettler (Ph.D. student, U. Maryland)  
Jon Klein (Ph.D. student, Chalmers U., Sweden)  
William La Cava (Ph.D. student, U. Massachusetts)  
Jason Lohn (Ph.D. student, U. Maryland)  
Sean Luke (Ph.D. student, U. Maryland)  
Blossom Metevier (Ph.D. student, U. Massachusetts)  
Eva Moshkovich (M.S. student, U. Massachusetts)  
Edward Pantridge (M.S. student, U. Massachusetts)  
Dov Pechenick (Ph.D. student, Dartmouth College)  
Anil Kumar Saini (Ph.D. student, U. Massachusetts)  
Oliver Seeliger (M.S. student, U. Maryland)  
Joshua Shinavier (Ph.D. student, Rensselaer Polytechnic Institute)  
Emma Tosch (Ph.D. student, U. Massachusetts)  
Terry Van Belle (Ph.D. student, U. New Mexico)

COURSES TAUGHT *In chronological order*

**Fall, 1986** at George Washington University, as a Teaching Assistant:  
Computer Science Projects

**Fall, 1992** at Hampshire College:  
Introduction to Computer Science: Programming Creative Processes  
Reasoning about Action

**January Term, 1993** at Hampshire College:  
Hypertext

**Spring, 1993** at Hampshire College:  
What Computers Can't Do  
Artificial Intelligence

**Fall, 1993** at Hampshire College:  
Introduction to Computer Science: Programming Creative Processes  
Advanced Topics in Artificial Intelligence: Creativity in Reasoned Response

**Spring, 1994** at Hampshire College:  
What Computers Can't Do  
Artificial Intelligence

**Fall, 1994** at Hampshire College:  
Introduction to Computer Science: Programming Creative Processes  
Advanced Topics in Artificial Intelligence

**Spring, 1995** at Hampshire College:  
Artificial Intelligence Research Laboratory  
Animals and Animats (with Mark Feinstein)

**Fall, 1996** at Hampshire College:  
Computing Concepts: Creative Machines?  
Artificial Intelligence

**Spring, 1997** at Hampshire College:  
The Nature of Mind: An Introduction to Cognitive Science  
Seminar in Artificial Intelligence: Evolutionary Computation

**Fall, 1997** at Hampshire College:  
Computing Concepts: Creative Machines?  
Creative Programming Workshop  
Visualizing Information: The Population Dilemma (Five College course led by Robert B. Hallock)

**Spring, 1998** at Hampshire College and Smith College:  
When Machines Talk (at Hampshire College, with Steve Weisler)  
Artificial Intelligence (at Hampshire College)  
Programming Language Paradigms (at Smith College)

**Fall, 1998** at Hampshire College:  
Cognitive Science Fiction  
Computing Concepts: Creative Machines?

**Spring, 1999** at Hampshire College:  
Computational Models of Biological Systems (with Michelle Murrain)

**Fall, 1999** at Hampshire College:  
Cognitive Science Fiction  
Seminar in Artificial Intelligence: Evolutionary Computation (with Jaime Davila)

**Spring, 2000** at Hampshire College:  
Artificial Intelligence

**Spring, 2001** at Hampshire College:  
Quantum Computing with No Prerequisites of Any Kind  
Artificial Intelligence

**Fall, 2001** at Hampshire College:  
Computing Concepts: Creative Machines?  
Seminar in Artificial Intelligence: Evolutionary Computation

**Spring, 2002** at Hampshire College:  
What Computers Can't Do

**Fall, 2003** at Hampshire College:  
Current Issues in Cognitive Science

**Spring, 2004** at Hampshire College:  
Artificial Intelligence

**Fall, 2004** at Hampshire College:  
Biocomputational Developmental Ecology (with Raymond Coppinger)

**Fall, 2006** at Hampshire College:  
Computing Concepts: Creative Machines?  
Current Issues in Cognitive Science

**Spring, 2007** at Hampshire College:  
Algorithmic Arts

Artificial Intelligence in 3D Virtual Worlds

**Fall, 2007** at Hampshire College:  
What Computers Can't Do  
Genetic Programming

**Spring, 2008** at Hampshire College:  
Computing Concepts  
Radical Innovation in Digital Arts (with Chris Perry)

**Fall, 2008** at Hampshire College:  
Cognitive Science Fiction  
Artificial Intelligence in 3D Virtual Worlds

**Spring, 2009** at Hampshire College:  
Computing Concepts  
Unconventional Computing

**Fall, 2009** at Hampshire College:  
Code Immersion  
Research Experience in Artificial Intelligence

**Spring, 2010** at Hampshire College  
Genetic Programming

**Fall, 2010** at Hampshire College  
Cognitive Science Fiction  
Creative Programming Workshop

**Spring, 2011** at Hampshire College  
Research in Artificial Intelligence

**Fall, 2011** at Hampshire College  
Genetic Programming  
Research Experience in Artificial Intelligence

**Fall, 2012** at Hampshire College  
Programming Creativity  
Genetic Programming

**Spring, 2013** at Hampshire College  
Research in Artificial Intelligence

**Fall, 2013** at Hampshire College  
Cognitive Science Fiction  
Unconventional Computing

**Spring, 2014** at Hampshire College  
Genetic Programming

**Fall, 2014** at Hampshire College  
Programming Creativity  
Artificial Intelligence

**Spring, 2015** at Hampshire College  
What Computers Can't Do

**Fall, 2015** at Hampshire College  
Artificial Intelligence  
Programming for Science

**Spring, 2016** at Hampshire College  
Evolutionary Computation

**Fall, 2017** at Hampshire College  
Beginning Coding for Science  
Artificial Intelligence

**Spring, 2018** at Hampshire College  
Frontiers in Biomathematics  
Genetic Programming

**Fall, 2018** at Hampshire College  
Cognitive Science Fiction  
Research in Artificial Intelligence

**Spring, 2019** at Hampshire College  
Programming Game Theory

**Fall, 2019** at Amherst College  
Introduction to Computer Science I (two sections)

**Spring, 2020** at Amherst College  
Data Structures  
Seminar in Computer Science: Evolutionary Computation

**Fall, 2020** at Amherst College  
Machine Learning (two sections)

**Spring, 2021** at Amherst College  
Introduction to Computer Science I (two sections)

**Fall, 2021** at Amherst College  
Introduction to Computer Science I (two sections)

**Spring, 2022** at Amherst College  
Introduction to Computer Science I  
Seminar in Computer Science: Evolutionary Computation

**Fall, 2022** at Amherst College  
What Computers Can't Do  
Machine Learning

INDEPENDENT  
STUDY COURSES  
SUPERVISED

Programming in Lisp (Fall, 1993)  
Independent Study in Algorithms and Data Structures (Fall, 1993)  
Project in Computer Science: Artificial Life E-Team (two students; Spring, 1994)  
Computability and Logic (Spring, 1994)  
The Hampshire College Virtual Student Union (Fall, 1994)

Project in Computer Science: Linux System Administration (Spring, 1995)  
 Project in Computer Science: Weeble World III: Weebles Avenged (three students; Spring, 1995)  
 Data Structures and Algorithms (Fall, 1997)  
 Artificial Intelligence and Cyborg Theory (Spring, 1998)  
 Computers, Quilts, and Calculus (Fall, 1998)  
 Data Structures (Spring, 1999)  
 Advanced Evolutionary Computing (Spring, 2002)  
 Parallel Programming (Fall, 2003)  
 Data Structures (Fall, 2003)  
 Basic Software Engineering & Interfaces (Fall, 2004)  
 Discrete Mathematics for Computer Science (Fall, 2004)  
 Artificial Intelligence (Fall, 2004)  
 Evolutionary Computation (Spring, 2005)  
 Lisp Programming (Fall, 2006)  
 Genetic Programming (Spring, 2007)  
 Evolution and Thought: An Introduction to Memetics (Spring, 2007)  
 Introduction to the Python Programming Language (Fall, 2007)  
 The C and C++ Programming Languages (Fall, 2007)  
 3D Gravitational Simulations (January Term, 2008)  
 Java Graphics Programming (January Term, 2008)  
 Functional Programming (Spring, 2008)  
 Computer Game Level Design using the Unreal Engine 3 (Fall, 2008)  
 Java Programming (two students; Spring, 2009)  
 Working through “Structure and Interpretation of Computer Programs” (two students; Spring, 2009)  
 Common Lisp and Scheme Programming (Spring, 2009)  
 Digital Empowerment: Teaching students to conquer the web (Spring, 2009)  
 Web Application Development with Ruby on Rails (Spring, 2009)  
 Introduction to Algorithms (Fall, 2009)  
 Artificial Intelligence and Game Design in Unity 3D (Fall, 2009)  
 Web Design (Fall, 2009)  
 Methods of Logic (January Term, 2010)  
 SAT Solver Research (Spring, 2010)  
 Exploration and Development of Music Software Technology (Spring, 2010)  
 Introduction to Algorithms (two students; Spring, 2010)  
 Using User Feedback and Integration to Improve a Digital Product (Spring, 2010)  
 Software Systems for Music and Sound (Spring, 2010)  
 Mathematical Logic (Fall, 2010)  
 Behind Facebook (Fall, 2010)  
 Teaching Data Structures & Algorithms to a Fellow Student (Fall, 2010)  
 Programming Chess (two students; January Term 2011)  
 The Semantic Web (Spring, 2011)  
 Programming Visuals for Musical Performance (Spring, 2011)  
 Microcomputers and Assembly Language (Spring, 2011)  
 Programming with Data Structures (Spring, 2011)  
 Audio-Reactive Computer Graphics (Spring, 2011)  
 Low-Tech Computing: The History, Theory, and Philosophy of Computer Science  
 (four students; Spring, 2011)  
 Research in Genetic Programming (Spring, 2012)  
 Introduction Genetic Programming: Evolving Computer Programs with PushGP  
 (two students; Spring, 2012)  
 Research in Computational Intelligence (Fall, 2012)  
 Human-Computer Interaction (Fall, 2012)  
 Game Theory (Fall, 2012)  
 Rebuilding ICU Hampy (two students; January Term, 2013)

Web Development and Entrepreneurship (January Term, 2013)  
 Visualizing Genetic Programming (January Term, 2013)  
 Advising Student Game Development Group (Spring, 2013)  
 Worldbuilding and Game Design (Spring, 2013)  
 Decision Theory & Automated Interactions (Spring, 2013)  
 Entrepreneurship and the Technology Market (Spring, 2013)  
 Creating randomly generated art (Spring, 2013)  
 Data Structures and Algorithms (Spring, 2013)  
 Discrete Math and Core Issues of Theoretical Computer Science (Spring, 2013)  
 Data Structures and Algorithms (two students; Fall, 2013)  
 Writing Chaos Theory (Fall, 2013)  
 Computational Intelligence Laboratory Research Group (two students; Fall, 2013)  
 Freelance Hardware Hacking (Fall, 2013)  
 Computational Intelligence Laboratory Research Group (two students; Spring, 2014)  
 Evolving Image Compression Degradation Judging Algorithm (Spring, 2014)  
 Programming in C# (Spring, 2014)  
 Natural Language Processing (Spring, 2014)  
 Computational Intelligence Laboratory Research Group (four students; Fall, 2014)  
 Evolution of Strategy: Settlers of Catan (Fall, 2014)  
 Functional Programming: Haskell & Clojure (Fall, 2014)  
 Yiddish in Games and Education (Fall, 2014)  
 Computational Intelligence Laboratory Research Group (three students; Spring, 2015)  
 Algorithms and Data Structures (Spring, 2015)  
 Real World App Creation Project (Fall, 2015) Computational Intelligence Laboratory (Spring, 2016)  
 Arduino-Based Machines to Assist Glassblowing (Spring, 2016)  
 Introduction to Algorithmic Composition in Clojure (Spring, 2016)  
 Introduction to Computer Science (Spring, 2016)  
 Data Science and Computer Science (Fall, 2017)  
 Python Programming for Psychology (Fall, 2017)  
 Mobile Application Development (two students; Spring, 2018)  
 Quantum Computation (Spring, 2018)  
 TUSH: Genetic Programming for Tensor-Based Machine-Learning Systems (Spring, 2018)  
 Introduction to Programming in Processing (Spring, 2018)  
 Computational Intelligence Laboratory (Fall, 2018)  
*The Unknowable Study* (Fall, 2018)  
 Computational Intelligence Laboratory (four students; Spring, 2019)  
 Creating a Crowd Simulation Platform (Spring, 2019)  
 Assembly Language and Microprocessors (Spring, 2019)  
 Computational Intelligence Laboratory (Fall, 2019)  
 Data Structures and Algorithms (Fall, 2019)  
 Computational Intelligence Laboratory Research (Spring, 2020)  
 Machine Learning (Spring, 2020)  
 Metaprogramming (Spring, 2020)  
 Programming Game Theory (two students; Fall, 2020)  
 Evolutionary Algorithms: Language Processing (Spring, 2021)  
 Machine Learning in Markets (Fall, 2021)  
 Artificial Humanity (Spring, 2022)  
 Accessible Mapping (Fall, 2022)

SOFTWARE  
DEVELOPMENT  
PROJECTS

*LGP, HiGP, MidGP, PushGP, Pushpop, Clojust, Propel, Propeller* and other tools for genetic programming research and applications. 1995–present.  
 See <http://hampshire.edu/lrspector/code.html> and <https://github.com/lrspector>.

*Rock Paper Stuff*, a game designed for artificial intelligence experiments and education. 2017.

See <https://github.com/l spectator/rock-paper-stuff>.

*Pucks*, An environment for experiments and education in artificial intelligence and artificial life. 2014–2016.

See <https://github.com/l spectator/pucks>.

*QGAME* (Quantum Gate and Measurement Emulator), a system for simulating quantum computer algorithms on ordinary (classical) computer hardware, based on the quantum gate array model of quantum computation. 1999–2005.

See <http://hampshire.edu/l spectator/qgame.html>.

*SwarmEvolve*, a framework for experiments on the emergence of collective behavior in populations of flying agents. 2002–2005. See

<http://hampshire.edu/l spectator/gecco2003-collective.html>.

*PLANET H*, a framework for experiments on the cognitive psychology of human planning. With Jordan Grafman at the National Institutes of Health, NINDS. 1996–1998.

*What about AIDS?*, WWW and CD ROM versions of the New York Hall of Science exhibit on AIDS. With Christopher Chase, Richard Muller, and Rebecca S. Neimark. 1994–1998.

*CHORES*, a framework for experiments on the cognitive psychology of human planning. With Jordan Grafman at the National Institutes of Health, NINDS. 1992–1996.

*ErunticLab*, an artificial life environment with genetic programming components. 1995. See <http://hampshire.edu/l spectator/code.html>.

Semantic network-based “Stream of Consciousness” interface concept for James Joyce *Ulysses* CD ROM. With StonySoft. 1994.

#### ARTS AND MEDIA PROJECTS

Simulation-based animations demonstrating gene flow for the *RACE: Are We So Different?* museum exhibit. With Alan Goodman and Robert Garfinkle. 2010.

*First Week*, audio composition derived from a Division Blocks simulation. Submitted to the Fundación Telefónica VIDA 10.0 International Competition.

<http://hampshire.edu/l spectator/firstweek/firstweek.html>.

*Selection Songs*, music produced by evolving agents in a 3D virtual world. *YLEM Journal*, Vol. 25, No. 6 & 8, pp. 24–26, and accompanying CD. With Jon Klein and Kyle Harrington. 2005.

*Albers Automaton, 13x13*, a digital projection piece based on the self-organization of colored fields. Gallery Tk (Northampton, Massachusetts); November 18 – December 5, 2004.

*CA3D*, projection artworks based on 3D cellular automata. Venues include Show Gallery’s October, 2002 MASQ fundraiser (Northampton, Massachusetts); Pablo (Bongohead) Yglesias’s 2002 Bar 19 show (Northampton, Massachusetts); Open Square Arts Party, April, 2004 (Holyoke, Massachusetts).

*SwarmEvolveMusic*, projection artworks (with audio) based on simulations of evolving, goal-directed swarms. Venues include Show Gallery’s October, 2002 MASQ fundraiser (Northampton, Massachusetts) and Bar 19 (Northampton, Massachusetts). 2002.

*Autonomous Color Studies*, flat panel/projection artworks based on 2D cellular automata. 1999.

*Adapta*, musical piece for singing audience and evolutionary computation. Invited concert presentation. New Music Mini-Festival, Center for the Arts, Wesleyan University. 1996.

*Twitchy*, interactive sculpture with video sensing and sound and servo motor motion output. Lemelson-funded E-Team project. Hampshire College. With James Carlson and Garth Zenie. 1995.

Speech activated interactive component of *King Anthracite* installation. With Stashu Kybartas. 1993.

*Life & Death*, interactive sound installation. 18th Annual Electronic Music Plus Festival. With Benjy Bernhardt and Rebecca S. Neimark. 1991.

## MEDIA

### *Quotes and Mentions*

*The Oberlin Alumni Magazine*, “The Spector Sound,” Fall, 2018.  
<https://www2.oberlin.edu/alummag/fall2018/issue/html5forpc.html?page=20>

*Quanta Magazine*, “Mathematical Simplicity May Drive Evolutions Speed,” by Jordana Cepelewicz. November 29, 2018.  
<https://www.quantamagazine.org/computer-science-and-biology-explore-algorithmic-evolution-20181129/>

*Sentient* interview for “Experts weigh in on the future of AI and evolutionary algorithms.” July, 2018. <https://www.sentient.ai/labs/experts/> or <https://www.youtube.com/watch?v=UWoWBiMowLI>

*The Boston Globe*, “Possible cheating uncovered in popular Harvard computer class,” by Travis Andersen and Brian MacQuarrie. May 5, 2017. <https://www.bostonglobe.com/metro/2017/05/04/possible-cheating-uncovered-popular-harvard-computer-class/4Wu2EfzWMEwXveBuu09qFJ/story.html>

*Harvard Business Review*, “There Will Always Be Limits to How Creative a Computer Can Be,” by Tony McCaffrey. April 24, 2017. <https://hbr.org/2017/04/there-will-always-be-limits-to-how-creative-a-computer-can-be>

*WFCR, National Public Radio*, “Rethinking Computer Intelligence,” by Karen Brown, radio story. June 17, 2014. <http://nepr.net/news/2014/06/17/rethinking-computer-intelligence/>

*Ars Technica* website, “Scientific computings future: Can any coding language top a 1950s behemoth?,” by Lee Phillips. May 7, 2014. <http://arstechnica.com/science/2014/05/scientific-computings-future-can-any-coding-language-top-a-1950s-behemoth/>

*New Scientist* magazine, “Wolf packs don’t need to cooperate to make a kill,” by Michael Marshall. Co-authored paper cited; co-author quoted. October 26, 2011.

*WFCR, National Public Radio*, “Hampshire Prof. Wins Grant to Create Computer Software That Can Evolve On Its Own,” by Fred Bever, radio story. September 6, 2010.

*The Daily Hampshire Gazette*, “Eureka: Evolution as world’s greatest calculator,” by Kristin Palpini. Column on the receipt of the gold medal in the “Human-Competitive Results” competition at the 2008 Genetic and Evolutionary Computation Conference. August 15, 2008.

*The Daily Hampshire Gazette*, news item on a grant from the NSF CreativeIT program. October 19, 2007.

*The Poughkeepsie Journal*, announcing “Evolutionary Computation for Science, Engineering and

Art,” a presentation at SUNY New Paltz. April 26, 2007.

*The Daily Hampshire Gazette*, news item on the receipt of the gold medal in the “Human-Competitive Results” competition at the 2004 Genetic and Evolutionary Computation Conference, by Cheryl B. Wilson. August 23, 2004.

*The Chronicle of Higher Education*, on receiving the NSF Director’s Award for Distinguished Teaching Scholars. “National Science Foundation Honors Teaching Scholars.” On-line version: May 9, 2003, <http://chronicle.com/prm/daily/2003/05/2003050905n.htm>

*The Daily Hampshire Gazette*, feature story on the NSF Director’s Award for Distinguished Teaching Scholars. “Hampshire prof wins national teaching award,” by Cheryl B. Wilson. May 12, 2003.

*The Daily Hampshire Gazette*, on the awarding of an NSF/MRI grant. May 13, 2002.

*The Daily Hampshire Gazette*, on the politics of software choices. “Hampshire takes lead on software,” by Stacey Butterfield. November 24, 2001.

*Technology Research News*, on the use of digital organisms in the study of evolutionary dynamics. “Virtual beings boost evolutionary theory,” by Ted Smalley Bowen. October 10, 2001.

*The Chronicle of Higher Education*, on open-source software. “Hampshire College Favors Noncommercial Web Software Open to All.” Print version: October 26, 2001, page A35.

*New Scientist*, on the use of genetic programming for applications in quantum computing. January 20, 2001.

*The Orlando Sentinel*, on robotic pets. “They Bark, They Byte. Robotic Rovers Are The Rage — Woof It Up With Our Computerized-Pets Guide.” Friday, December 8, 2000.

*Details* magazine, on the possibility of computers having senses of humor. “Take My Hard Drive... Please; A computer may have beaten chess champion Garry Kasparov, but will one ever be able to tell a joke?” March, 2000.

*The Daily Hampshire Gazette*, on the importance of computers in the 20th century. “It was a century for invention.” January 1/2, 2000.

*Salon.com* on-line magazine, on genetic programming applications to quantum computing and jazz composition. “Software that Writes Software.” August 10, 1999. [http://www.salon.com/tech/feature/1999/08/10/genetic\\_programming/index.html](http://www.salon.com/tech/feature/1999/08/10/genetic_programming/index.html)

*Scientific American*, on the use of “cultures” in genetic programming and on ontogenetic programming. “Programming With Primordial Ooze.” October, 1996.

#### MEMBERSHIPS

Institute of Electrical and Electronics Engineers (IEEE), Senior Member  
Association for Computing Machinery (ACM)  
ACM SIGEVO, Executive Committee Member  
International Society for Artificial Life