David Doty CV

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Associate Professor
Department of Computer Science
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Research interests

- DNA nanotechnology, chemical reaction networks, algorithmic self-assembly, distributed computing, algorithmic information theory

Academic positions

- **University of California, Davis**, Davis, California, USA
  Jul. 2015 – present
  Associate Professor of Computer Science 2021 – present
  Assistant Professor of Computer Science 2015 – 2021
  member of Graduate Group in Applied Mathematics
- **California Institute of Technology**, Pasadena, California, USA
  Sep. 2010 – Jul. 2015
  Senior Research Fellow/Postdoctoral Scholar in Computing and Mathematical Sciences
  Supervisor: Erik Winfree
- **Western University (formerly University of Western Ontario)**, London, Ontario, Canada
  Sep. 2009 – Sep. 2010
  Postdoctoral Fellow in Computer Science
  Supervisor: Lila Kari

Education

- **Iowa State University**, Ames, Iowa, USA
  Ph.D. in Computer Science, 2009
  Ph.D. Thesis: *Applications of the theory of computation to nanoscale self-assembly*
  Advisors: Jack H. Lutz and James I. Lathrop
- **Iowa State University**, Ames, Iowa, USA
  M.S. in Computer Engineering, 2002
  Master's Thesis: *Genetic algorithm-based simulation of electric power markets*
  Advisor: Gerald B. Sheblé
- **Iowa State University**, Ames, Iowa, USA
  B.S. in Computer Engineering, 2001
  Honors Thesis: *Evolving 3-D tic-tac-toe strategies*
  Honors Advisor: Daniel Ashlock

Awards

- UC-Davis College of Engineering Outstanding Junior Faculty Research Award, 2020
- NSF CAREER award, 2019
- Best paper award at DISC 2014, "Speed faults in computation by chemical reaction networks", with Ho-lin Chen, Rachel Cummings, and David Soloveichik
- Aalto Science Fellowship, 2012, 3-year postdoc fellowship to pursue independent research at Aalto University, Helsinki, Finland, awarded to 3 recipients out of 167 applicants (declined)
- CCC-CRA-NSF Computing Innovation Fellowship, 2010, 2-year postdoc fellowship
- Iowa State Univ. Teaching Excellence Award, 2007
- Pioneer Hi-Bred/National Science Foundation Graduate Research Fellowship (2005–2006)
- National Science Foundation Integrative Graduate Education and Research Traineeship (IGERT) Fellowship (2002–2004)
- Iowa State Univ. Electrical and Computer Engineering Graduate Excellence Fellowship (2002)

PUBLICATIONS
- Official publications list: https://web.cs.ucdavis.edu/~doty/papers/
- Google Scholar
- DBLP

INVITED TALKS
- https://web.cs.ucdavis.edu/~doty/papers/#talks

GRANTS

- **Principal investigator**
  - *Engineerable molecular computing: flying like an airplane, not like a bird*, $400,000, NSF CISE/CCF/FET grant, 2019-2023, NSF award #CCF-1900931
  - *CAREER: Chemical computation that is error-free, uniform, and composable*, $532,000, NSF CAREER award, 2019-2024, NSF award #CCF-1844976
  - *Kinetics and Thermodynamics of Chemical Computation*, $266,000, NSF CISE/CCF/AF grant, 2016-2019, NSF award #CCF-1619343
  - *Theory of Molecular Programming: Computability and Complexity*, $425,000, NSF CISE/CCF/AF grant, 2012-2015, (co-PI: Damien Woods), NSF award #CCF-1219274
- **Co-principal investigator**
  - *Student Travel Support for BIRS Workshop on Programming Chemical Reaction Networks*, $5000, NSF CISE/CCF/AF grant, 2014, (PI: Lulu Qian, co-PIs: David Doty, Chris Thachuk), NSF award #CCF-1442454
  - *Scaling Up Programmable and Algorithmic DNA Self-Assembly*, $400,000, NSF CISE/CCF/AF grant, 2012-2015, (PI: Erik Winfree, co-PIs: David Doty, Damien Woods), NSF award #CCF-1162589
  - *Future directions for molecular programming: DNA17 special session*, $15,000, NSF, 2011, (PI: Erik Winfree, co-PIs: David Doty, Niles Pierce, Damien Woods), NSF award #CCF-1143993
  - *Student Travel Support for DNA17*, $12,000, NSF, 2011, (PI: Erik Winfree, co-PIs: David Doty, Niles Pierce, Damien Woods), NSF award #CCF-1137770

STUDENTS SUPERVISED

- **Ph.D.**
  - Mahsa Eftekhari, currently Ph.D. candidate in Computer Science, UC-Davis
  - Eric Severson, Ph.D. in Applied Mathematics, 2021, UC-Davis
  - David Haley, Ph.D. in Applied Mathematics, 2021, UC-Davis
- **M.S.**
  - Aaron Ong, currently M.S. candidate in Computer Science, UC-Davis
  - Amanda Belleville, M.S. in Computer Science, 2017, UC-Davis
    now Software Application Engineer at Workday
  - Shaopeng Zhu, M.S. in Computer Science, 2017, UC-Davis
    now Ph.D. student in Computer Science at University of Maryland, College Park
- **Undergraduate**
  - Cesar Alonso Guzman Avina, 2021, UC-Davis undergraduate REU project, DNA structure design software
  - Sarah Yuniar, 2021, UC-Davis undergraduate REU project, DNA structure design software
  - Anelise Cho, 2020–2021, UC-Davis undergraduate project through AvenueE and VIP programs, project on surface CRNs
  - Benjamin Lee, 2019–2021, UC-Davis undergraduate REU project, DNA structure design software and DNA sequence design software

- Andres Rojas, 2018, UC-Davis undergraduate project, population protocol simulation
- Vishal Chakraborty, 2016-2017, UC-Davis Honors thesis and REU project, theory of chemical reaction networks
- Nicholas Schiefer, 2015, Caltech SURF (Summer undergraduate research fellowship), theory of algorithmic self-assembly/chemical reaction networks
- Aakash Indurkhya, 2013, Caltech SURF (Summer undergraduate research fellowship), theory of computation with chemical reaction networks
- Felix Zhou, 2012, Caltech SURF (Summer undergraduate research fellowship), experiments with algorithmic self-assembly of DNA single-stranded tiles
- Nathaniel Bryans, 2010, University of Western Ontario summer research project, theory of algorithmic self-assembly

◇ **High school**

- Andrea Jia, 2021, project with DNA structure design software.
- Rishabh Mudradi, 2020-2021, project with DNA structure design software.
- Jupinder Parmar, 2016-2018, project with theoretical algorithmic self-assembly.

◇ **Thesis/Qualifying exam committee** Jack Wesley, Talley Amir (external committee member for Yale CS department), Kyle Ray, Sung Kook Kim, Anshuman Chhabra, Jonathan Marrs, Ronaldo Ortez, Boya Wang (external committee member for UT-Austin ECE department), David Grzan, Greg Wimsatt, Luiz Irber, David Gier, Alexandra Jurgens, Samuel Loomis, Ariadna Venegas-Li, Anastasiya Salova, Thong Le, Julia Matsieva, Adam Rupe, Haochen Wu, Paul Riechers, Rafael Bravo

Service

◇ **Program committee co-chair**

- **UCNC 2020**: 19$^{\text{th}}$ Conference on Unconventional Computation/Natural Computation
- **DNA 2018**: 24$^{\text{th}}$ Meeting on DNA Computing and Molecular Programming

◇ **General conference co-chair**

- **FNANO 2021**: 18$^{\text{th}}$ Annual Conference on Foundations of Nanoscience: Self-assembled Architectures and Devices

◇ **Program committee member**

- **DNA** (2014–2021, 2012, 2011): International Meeting on DNA Computing and Molecular Programming
- **ICALP** (2022): International Colloquium on Automata, Languages, and Programming
- **DISC** (2020, 2017): International Symposium on DIStributed Computing
- **OPODIS** (2017): International Conference on Principles of Distributed Systems
- **SAND** (2021): Symposium on Algorithmic Foundations of Dynamic Networks
- **CiE** (2016): Computability in Europe Conference
- **UCNC** (2020, 2019, 2015, 2012): Conference on Unconventional Computation/Natural Computation
- **VEMDP** (2018): International Workshop on Verification of Engineered Molecular Devices and Programs, affiliated with CAV (Conference on Computer Aided Verification)

◇ **Workshop chair**

- Minisymposium on Algorithmic Chemical Reaction Networks, at **CanaDAM 2015**: 5th Canadian Discrete and Algorithmic Mathematics Conference

◇ **Organizing committee**

- Programming with Chemical Reaction Networks: Mathematical Foundations, 2014 Workshop at Banff International Research Station for Mathematical Innovation and Discovery

- **DNA 2011**: 17th Meeting on DNA Computing and Molecular Programming

◇ **Journal referee**: *Nature Communications*, PNAS: *Proceedings of the National Academy of Sciences*, CACM: *Communications of the ACM*, SICOMP: *SIAM Journal on Computing*, ACS SynBio: *ACS Synthetic Biology*, *PLOS ONE*, *Journal of the Royal Society: Interface*, *IEEE Transactions on Information Theory*, JoVE: *Journal of Visualized Experiments*, DIST: *Distributed Computing*, JCB: *Journal of Computational Biology*, *Algorithmica*, JCSS: *Journal of Computer and System Sciences*, I&C: *Information and Computation*, IPL: *Information Processing Letters*, TCS: *Theoretical Computer Science*, ToCS: *Theory of Computing Systems*, NaCo: *Natural Computing*, *IEEE Transactions on NanoBioscience*, *International Journal of Computer Mathematics*, *Mathematics and Computers in Simulation*, *BioSystems*, *IET Nanobiotechnology*, *Information*, *Chaos*, *Advanced Science Letters*

◇ **Conference reviewer**: DNA: *DNA Computing and Molecular Programming*, STOC: *ACM Symposium on Theory of Computing*, FOCS: *IEEE Symposium on Foundations of Computer Science*, SODA: *ACM-SIAM Symposium on Discrete Algorithms*, PODC: *ACM Symposium on Principles of Distributed Computing*, DISC: *International Symposium on DIStributed Computing*, ICALP: *International Colloquium on Automata, Languages, and Programming*, ESA: *European Symposium on Algorithms*, SPAA: *ACM Symposium on Parallelism in Algorithms and Architectures*, CCC: *International Conference on Computational Complexity*, STACS: *International Symposium on Theoretical Aspects of Computer Science*, POPL: *Principles of Programming Languages*, ISAAC: *International Symposium on Algorithms and Computation*, CiE: *Computability in Europe*, RECOMB: *Research in Computational Molecular Biology*, CMSB: *International Conference on Computational Methods in Systems Biology*, COCOON: *International Computing and Combinatorics Conference*

◇ **National Science Foundation panelist:** 2013, 2017, 2019, 2021

◇ **University service**:

- University of California, Davis:
  - Undergraduate affairs, Computer Science, 2017-present
  - Faculty liason to CS Club, 2017-present
  - Faculty search, Computer Science, 2021, 2020, 2017
  - Faculty representative committee, Computer Science, 2021
  - Graduate admissions, Computer Science, 2018, 2016
- California Institute of Technology:
  - Graduate admissions, Computer Science, 2014, 2013

◇ **Media**: Video introducing algorithmic self-assembly to a (mostly) lay audience, made to accompany a review article on the same subject: https://vimeo.com/54214122

◇ **Interviews**:

- Machine Intelligence Research Institute: Luke Muehlhauser, on algorithmic self-assembly http://intelligence.org/2014/04/23/dave-doty/

◇ **Outreach**:

- Story consultant for Isa, made-for-TV movie on SyFy, 2014 (main character is a gifted Latina high school student interested in computer science and mathematics)
- Judge for 2013 Caltech SURF (Summer Undergraduate Research Fellowship) poster competition
- Speaker and discussion leader at 2012 Siemens Competition in Math, Science, and Technology
- Hosted Pasadena high school biology students in lab for educational seminar about careers in science

◇ **Professional memberships**

- International Society for Nanoscale Science, Computation, and Engineering (ISNSCE)
- Association for Computing Machinery (ACM), Special Interest Group in Algorithms and Computation Theory (SIGACT)

Teaching experience

◇ **Instructor**, University of California, Davis (as faculty), Fall 2015 – present

- Theory of Computation (graduate)
- Theory of Computation (undergraduate)
- Theory of Molecular Computation (graduate)
- Developed software to support grading and feedback:
  - **Simulators for Theory of Computing:** http://web.cs.ucdavis.edu/~doty/automata/ Web applications for simulating deterministic and nondeterministic finite automata, regular expressions, context-free grammars, and Turing machines. They are used by my Theory of Computation students for creating and testing automata to submit for homework. In conjunction with Gradescope (https://gradescope.com/), this enables automated grading of homework, with immediate feedback to the students to enable them to learn and improve immediately.

◇ **Instructor**, Iowa State University (as a Ph.D. student), Summer 2006 – Spring 2009

- Theory of Computation (undergraduate)
- Introduction to Object-Oriented Programming in Java
- Data Structures in Java
- Programming for non-CS-majors in Java

◇ **Graduate teaching assistant**, Iowa State University, Summer 2001, Spring 2002, Fall 2004 – Spring 2005, Summer 2007

- Introduction to Circuits for non-EE-majors
- System Modeling, Simulation, and Optimization
- Programming for non-majors in Java
- Introduction to Object-oriented Programming in Java
- Data Structures in Java

◇ **Developed course materials** for introductory programming and data structures courses on a grant from Caterpillar, Inc. during Summer 2005, Iowa State University

◇ **Tutor**, Iowa State University, Spring 1999, Spring 2000

- Classical Physics
- Introduction to Digital Design
- Algorithm Design and Analysis