

# Peng Yin

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## Education and Academic Experience

- Assistant Professor, Department of Systems Biology, Harvard Medical School (Jan. 2010 - present)
- Core faculty member, Wyss Institute for Biologically Inspired Engineering, Harvard University (Jan. 2010 - present)
- Senior Postdoctoral Scholar (July 2007 - Dec. 2009), Postdoctoral Scholar (Sep. 2005 - June 2007), Department of Bioengineering, Department of Computer Science, Center for Biological Circuit Design, Caltech  
Advisors: *Niles A. Pierce* and *Erik Winfree*
- Ph.D. in Computer Science, Duke University, May 2005.  
Thesis: DNA Based Self-Assembly and Nano-Devices: Theory and Practice.  
Advisor: *John H. Reif*
- M.S. in Molecular Cancer Biology, Duke University, Dec. 2000.
- Certificate in Cell and Molecular Biology, Duke University, Dec. 2000.
- B.S. in Biochemistry and Molecular Biology, Peking University, China, July 1998.
- Bachelor of Economics, Peking University, China, July 1998.

## Research Interests

My research interests lie at the interface of information science, molecular engineering, and biology. The current focus is to engineer information directed self-assembly of nucleic acid (DNA/RNA) structures and devices, and to exploit such systems to do useful molecular work, e.g. probing and programming biological processes for bioimaging and therapeutic applications.

## Peer Reviewed Publications

### *Most Significant Work*

(\* corresponding author)

1. P. Yin, H.M.T. Choi, C.R. Calvert and N.A. Pierce\*. *Programming Biomolecular Self-Assembly Pathways*. *Nature*, 451:318-322, 2008
  - We invented a DNA hairpin motif and an associated abstraction system for programming dynamic molecular behavior. Molecular programs were executed for a variety of dynamic functions: catalytic geometry, catalytic circuitry, nucleated dendritic growth, and autonomous locomotion.
  - Academic commentaries on this paper include: “Biomolecular assembly: Dynamic DNA”, W. Shih, *Nature Materials*, 7:98-100, 2008; “Tying New Knots in Synthetic Biology”, D.K. Karig and M. L. Simpson, *HFSP Journal*, 3:124-128, 2008; and “Rational Engineering of Dynamic DNA Systems”, U. Feldkamp and C.M. Niemeyer, *Angew. Chem. Int. Ed.*, 47:3871-3873, 2008.
  - Highlighted in “The Year in Nature (2008)”. Press coverage of this paper includes *New Scientist*, *National Science Foundation (NSF) home page*, *Caltech homepage*, and many other news agencies.
2. P. Yin\*, R.F. Hariadi, S. Sahu, H.M.T. Choi, S.H. Park, T.H. LaBean and J.H. Reif. *Programming DNA Tube Circumferences*. *Science*, 321:824-826, 2008.

- A novel 42-nucleotide single-stranded DNA motif is programmed to form monodisperse molecular tubes, displaying 4, 5, 6, 7, 8, 10, and 20 circumferential helices.
  - Highlighted in Nature Nanotechnology. Featured on Caltech homepage, by nanotechweb.org and many other news agencies.
3. P. Yin, H. Yan\*, X.G. Daniell, A.J. Turberfield\* and J.H. Reif\*. *A Unidirectional DNA Walker That Moves Autonomously Along a Track*. *Angew. Chem. Int. Ed.*, 43:4906-4911, 2004.
    - We demonstrate, for the first time, the experimental construction of an autonomous synthetic DNA walker.
    - Featured by Technology Research News among nano-technology breakthroughs in 2004.

### *DNA Based Nano-Devices and Nano-Structures*

1. P. Yin, S. Sahu, A.J. Turberfield and J.H. Reif. *Design of Autonomous DNA Cellular Automata*. In Proc. 11th International Meeting on DNA Computing (DNA11), 2005. *Lecture Notes in Computer Science*, 3892:399-416, 2006.
2. Y. Tian, Y. He, Yi Chen, P. Yin and C. Mao. *A DNazyme That Walks Processively and Autonomously along a One-Dimensional Track*. *Angew. Chem. Int. Ed.*, 44:4355-4358, 2005.
3. S.H. Park, P. Yin, Y. Liu, J.H. Reif, T.H. LaBean and H. Yan. *Programmable DNA Self-Assemblies for Nanoscale Organization of Ligands and Proteins*. *Nano Letters*, 5:729-733, 2005.
4. P. Yin, A.J. Turberfield and J.H. Reif. *Designs of Autonomous Unidirectional Walking DNA Devices*. In Proc. 10th International Meeting on DNA Computing (DNA10), 2004. *Lecture Notes in Computer Science*, 3384:410-425, 2005.
5. P. Yin, A.J. Turberfield, S. Sahu and J.H. Reif. *Design of an Autonomous DNA Nanomechanical Device Capable of Universal Computation and Universal Translational Motion*. In Proc. 10th International Meeting on DNA Computing (DNA10), 2004. *Lecture Notes in Computer Science* 3384:426-444, 2005.

### *Self-Assembly Theory*

({ } alphabetical author order)

1. S. Sahu, P. Yin and J.H. Reif. *A Self-Assembly Model of DNA Tiles with Time Dependent Glue Strength*. In Proc. 11th International Meeting on DNA Computing (DNA11), 2005. *Lecture Notes in Computer Science*, 3892:290-304, 2006.
2. {J.H. Reif, S. Sahu and P. Yin}. *Complexity of Graph Self-Assembly in Accretive Systems and Self-Destructible Systems*. In Proc. 11th International Meeting on DNA Computing (DNA11), 2005. *Lecture Notes in Computer Science*, 3892:257-274, 2006.
3. {J.H. Reif, S. Sahu and P. Yin}. *Compact Error-Resilient Computational DNA Tiling Assemblies*. In Proc. 10th International Meeting on DNA Computing (DNA10), 2004. *Lecture Notes in Computer Science*, 3384:293-307, 2005.

### *Computational and Experimental Biology*

1. P. Yin and A.J. Hartemink. *Theoretical and Practical Advances in Genome Halving*. *Bioinformatics*, 21:869 - 879, 2005.
2. A. Sekulic, C.C. Hudson, J.L. Homme, P. Yin, D.M. Otterness, L.M. Karnitz and R.T. Abraham. *A Direct Linkage Between the Phosphoinositide 3-Kinase-AKT Signaling Pathway and the Mammalian Target of Rapamycin in Mitogen-Stimulated and Transformed Cells*. *Cancer Research*, 60:3504 - 13, 2000.

### *Algorithms and Complexity*

1. {P.K. Agarwal, Y. Wang and P. Yin}. *Lower Bound for Sparse Euclidean Spanners*. In Proc. 16th ACM-SIAM Symposium on Discrete Algorithms (SODA'05), pages 670-671, 2005.

*In Preparation*

1. P. Yin, H.L. Chen, N.L. Dabby, P.G. Mullen, N.A. Pierce and E. Winfree. *Active Self-Assembly of Algorithmic Shapes in Logarithmic Time*. Draft.

## Academic Talks

1. Department of Chemistry, Brandeis University, Boston, Nov. 1st, 2010.
2. Theory Lunch, Department of Systems Biology, Harvard Medical School, Boston, May 21st, 2010.
3. Workshop on Bio-Directed Assembly, Keystone, CO, May 18th, 2010.
4. “New Directions in Synthetic Biology” Symposium, Boston, Apr. 30th, 2010.
5. “Duke Nanoscience Seminar Series”, Duke University, Durham, Mar. 30th, 2010.
6. Center for Physics and Biology, Rockefeller University, New York City, Mar. 23rd, 2010.
7. Department of Systems Biology, Harvard Medical School, Boston, Mar. 3rd, 2010.
8. School of Engineering and Applied Sciences, Harvard University, Cambridge, Feb. 23rd, 2010.
9. NSF Molecular Programming Project Workshop, Oxnard, Jan. 10th, 2010.
10. Qingdao Institute of BioEnergy and Bioprocess Technology, Chinese Academy of Sciences, Qingdao, July 27th, 2009.
11. Chinese Academy of Science Workshop on DNA Nanotechnology, Beijing, July 17th, 2009.
12. Emergence in Chemical Systems 2.0 Conference, Anchorage, June 25th, 2009.
13. Center for Computational Biology and Bioinformatics, Columbia Medical School, New York City, May 22nd, 2009.
14. Dept. of Biomedical Engineering, Boston University, Boston, Apr. 10th, 2009.
15. Wyss Institute for Biologically Inspired Engineering, Dept. of Systems Biology, Harvard Medical School, Boston, Apr. 8th, 2009.
16. Wyss Institute for Biologically Inspired Engineering, School of Engineering and Applied Sciences, Harvard University, Cambridge, Apr. 7th, 2009.
17. Dept. of Electrical Engineering, Columbia University, New York City, Mar. 31st, 2009.
18. Dept. of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, Mar. 16th, 2009.
19. Dept. of Mechanical Engineering, University of California, Santa Barbara, Mar. 2nd, 2009.
20. Dept. of Bioengineering, Rice University, Houston, Feb. 18th, 2009.
21. Dept. of Chemical and Biomolecular Engineering, Johns Hopkins University, Baltimore, Feb. 5th, 2009.
22. SBE’s 2nd International Conference on Biomolecular Engineering, Santa Barbara, Jan. 21st, 2009.
23. Dept. of Chemistry, University of California, Berkeley, Dec. 11th, 2008.
24. Dept. of Electrical Engineering, University of Washington, Seattle, Dec. 1st, 2008.
25. Dept. of Computer Science, Caltech, Pasadena, Nov. 18th, 2008.
26. Dept. of Chemistry, Peking University, Beijing, China, Oct. 14th, 2008.
27. National Center for Nanoscience and Technology, Beijing, China, Oct. 14th, 2008.

28. 236th American Chemical Society (ACS) National Meeting, Philadelphia, Aug. 20th, 2008.
29. 236th American Chemical Society (ACS) National Meeting, Philadelphia, Aug. 19th, 2008.
30. Fifth Conference on Foundations of Nanoscience: Self-Assembled Architectures and Devices (FNANO5), Snowbird, Utah, April 24th, 2008.
31. Twelfth International Meeting on DNA Based Computers (DNA12), Seoul, Korea, June 7th, 2006.
32. NSF Center for Molecular Cybernetics Workshop, Ann Arbor, May 16th, 2006.
33. Third Conference on Foundations of Nanoscience: Self-Assembled Architectures and Devices (FNANO3), Snowbird, Utah, April 23rd, 2006.
34. Eleventh International Meeting on DNA Based Computers (DNA11), London, Canada, June 7th, 2005.
35. Second Conference on Foundations of Nanoscience: Self-Assembled Architectures and Devices (FNANO2), Snowbird, Utah, April 23rd, 2005.
36. First Conference on Foundations of Nanoscience: Self-Assembled Architectures and Devices (FNANO1), Snowbird, Utah, April 22nd, 2004.

## Patents and Patent Applications

1. D. Zhang and P. Yin, *Nucleic Acid Probe Systems*. U.S. Provisional patent, filed Sep. 2010.
2. P. Yin and N.A. Pierce, *Triggered RNAi-based Fluorescence Imaging*. U.S. Provisional patent, filed May 22nd, 2008.
3. P. Yin and N.A. Pierce, *Quenched Nucleic Acid Probes as Quantitative Fluorescence Signal Amplifiers for in situ and in vivo Bioimaging*. U.S. Provisional patent, filed May 22nd, 2008.
4. N.A. Pierce, P. Yin and J.R. Viereg, *Exquisite Specificity for in situ Hybridization Experiments*. U.S. Provisional patent, filed May 21st, 2008.
5. P. Yin, R.F. Hariadi, S. Sahu, T.H. LaBean and J.H. Reif. *DNA structures self-assembled from single stranded DNA tiles: Chains, Ribbons, and Tubes*. U.S. Provisional patent, filed Mar. 24th, 2008.
6. N.A. Pierce and P. Yin. *Mechanisms for Implementing Triggered RNAi*. U.S. Provisional patent, filed Feb. 27th, 2008.
7. P. Yin and N.A. Pierce. *A Versatile Nucleic Acid Hairpin Motif for Programming Biomolecular Self-Assembly Pathways*. U.S. Provisional patent, filed May 16th, 2007. U.S. Non-provisional patent, filed May 16th, 2008. Pending.
8. J.H. Reif, P. Yin, T.H. LaBean, G. Shetty and E.A. Schultes. *Analyte Detection Using Autocatalytic Chain Reactions*. U.S. Provisional patent application no. 60/915,659, filed May 2nd, 2007.
9. N.A. Pierce and P. Yin. *Triggered RNAi*. U.S. Provisional patent application no. 60/904,571, filed March 1st, 2007. U.S. Non-provisional patent application no. 12/040,735, filed Feb. 29th, 2008. Pending.

## Research Staff and Students Supervised

- Postdoc doctoral scholar: Wei Sun, Diming Wei, David Y. Zhang, Tom Schaus
- Graduate students: John Sadowski, Adam Marblestone, Joanne Ho
- Research associates: Colby R. Calvert, Wesley Lin, G. Shetty, Robert Barish
- Undergraduate students: Jiaqi Guo, Max Grazier G'Sell, Connie Gao, Alexander Hudson, Amy Guan
- High school student: Bethany Walters

## Teaching Experience

1. Teaching Assistant, Distributed Information Systems (graduate level), Duke University, Aug. 2002 - Dec. 2002.
2. Teaching Assistant, Software Design and Implementation (undergraduate level), Duke University, Aug. 2001 - Dec. 2001.
3. Teaching Assistant, Software Design and Implementation (undergraduate level), Duke University, Jan. 2001 - May 2001.

## Awards and Recognition

1. NIH Director's New Innovator Award, 2010
2. Finalist, Feynman Prize for Nanotechnology in the Experiment category, with N.A. Pierce and R.M. Dirks, 2008
3. Finalist, Burroughs Wellcome Fund Career Award at the Scientific Interface, 2006.
4. Postdoctoral Fellowship, Center for Biological Circuit Design, Caltech, 2005 - 2009.
5. Best Dissertation Award, Department of Computer Science, Duke University, 2005.
6. Chinese National Award for Outstanding Overseas Students, 204 awardees worldwide, sponsored by Ministry of Education of the Peoples Republic of China, 2005.
7. Best Student Paper Award, Tenth International Meeting on DNA Based Computing (DNA10), 2004.
8. Graduate Fellowship, Duke University, Sep. 2000 - Aug. 2001.
9. Graduate Fellowship, Program in Cell and Molecular Biology, Duke University, Sep. 1998 - Aug. 2000.
10. All-Excellent Student Scholarship, Peking University, China, 1996.
11. Pratahana Life Science Scholarship, Peking University, China, 1995.
12. First Class Academic Merit Scholarship, Peking University, China, 1994.

## Services

### *Refereeing Service*

- Journals: Nature Nanotechnology, Angew. Chem. Int. Ed., Nucleic Acids Research, Trends in Biotechnology, Chemistry - A European Journal, Journal of Biomolecular Structure and Dynamics, Natural Computing, BioSystems, IEEE Transaction on Computers, Journal of Current Nanoscience, Theoretical Computer Science
- Conferences: International Conference on DNA Based Computers (DNA), Symposium on Discrete Algorithms (SODA), Knowledge-based Intelligent Information and Engineering Systems (KES), Workshop on Algorithms in Bioinformatics (WABI)

### *Conference Program Committee Service*

- Session chair, Biomolecular computing, Institute of Biological Engineering (IBE) Annual Meeting, 2010.
- Organizing committee: "New Directions in Synthetic Biology" Symposium, Boston, Apr. 30th, 2010.
- Organizing committee: Foundations of Nanoscience: Self-Assembled Architectures and Devices (FNANO), 2004, 2005.

*Professional Associations*

- American Association for the Advancement of Science
- Sigma Xi Scientific Research Society
- Biophysical Society
- American Chemical Society
- International Society for Nanoscale Science, Computation and Engineering

*Community Service & Leadership*

- President, Chinese Students and Scholars Association, Duke University, May 1999 - May 2000.
- President, Class 1994, Department of Biochemistry and Molecular Biology, Peking University, China, Sep. 1995 - Sep. 1996.

Last updated: November 15, 2010.