

Stephen R. Quake

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Education:

- 1994: D.Phil. Physics, Oxford University, England.
Thesis title: "Theory and Experiments in Polymer Physics with Single Molecules of DNA".
Thesis advisor: Robin Stinchcombe.
- 1991: M.S. Mathematics, Stanford University.
B.S. Physics, Stanford University, with honors and distinction.

Employment:

- 2006-present: Investigator, Howard Hughes Medical Institute
2004-present: Professor of Bioengineering, Stanford University
2004-2005: Thomas E. and Doris Everhart Professor of Applied Physics and Physics, C.I.T.
2003-2004: Professor of Applied Physics and Physics, C.I.T.
2002-2003: Associate Professor of Applied Physics and Physics, C.I.T.
1999-2002: Associate Professor of Applied Physics, C.I.T.
1996-1999: Assistant Professor of Applied Physics, California Institute of Technology.
1994-1996: Post-doctoral associate, Steven Chu group, Stanford University

Honors and Awards:

- NIH Director's Pioneer Award (2004)
Named to the TR100 "100 Young Innovators that will create the future" by MIT Tech Review magazine (2002)
Named as example of "top 10 areas in emerging technology" by MIT Tech Review magazine (2001)
Participant in the N.A.S. Symposium for Frontiers in Science (2000)
Packard Fellow (1999)
Participant in the N.A.E. Symposium for Frontiers in Engineering (1999)
NSF "Career" award (1997)
NIH R29 "FIRST" award (1997)
Visiting scholar at "Topology and Geometry in Polymer Science", U. Minnesota (1996)
National Science Foundation Graduate Fellow (1993)
Marshall Scholar (1991)
Apker Award (American Physical Society, 1991)
Firestone Prize (Stanford University, 1991)

Phi Beta Kappa (Stanford University, 1991)

Professional:

Judge for the MIT Technology Review TR100 (2003).

Defense Science Study Group (2002-3).

Program Sub-Committee member and session chair, CLEO/QELS (1999,2000).

Visiting committee for Bioengineering, RPI (2000).

Panel Member, Biological Analysis Systems Expert Panel, MITRE (1999-present).

Panel member, ARES II (DoD) (2000).

Organizing Committee for the NAS Symposium for Frontiers in Science, 2001,2002.

Peer reviewer for NSF, NIH, Foundation for Fundamental Research on Matter

(Netherlands), *Science*, *Physical Review Letters*, *Physical Review*, *Nature Biotechnology*, *Proceedings of the National Academy of Sciences*, *Nature Structural Biology*, and others.

Consulting:

Fluidigm, Inc.: Co-founder, former Director and Chair of the Scientific Advisory Board (1999-present).

Pharma Genomix (2000-present)

Axon Instruments (2003)

Intel Corporation (2003)

Helicos, Inc.: Co-founder, former Director and Chair of the Scientific Advisory Board (2003-present)

Molecular Technologies, Inc (MTI) (2004-2005)

Publications (refereed archival journals):

- Lacenere CJ, Garg NK, Stoltz BM, Quake SR. "Effects of a Modified Dye-Labeled Nucleotide Spacer Arm on Incorporation Thermophilic DNA Polymerases". *Nucleosides, Nucleotides & Nucleic Acids*. 25:9-15, 2006.
- Lee CC, Sui G, Elizarov A, Shu CJ, Shin YS, Dooley AN, Huang J, Daridon A, Wyatt P, Stout D, Kolb HC, Witte ON, Satyamurthy N, Heath JR, Phelps ME, Quake SR, and Tseng HR. "Multistep Synthesis of a Radiolabeled Imaging Probe Using Integrated Microfluidics" *Science*. 16 December 2005: 1793-1796.
- Squires TM, Quake SR. "Microfluidics: Fluid physics at the nanoliter scale" *Rev. Mod. Phys.* July 2005, 7:3 pp. 977-1026.
- Garg NK, Woodroffe CC, Lacenere CJ, Quake SR, Stoltz BM. "A ligand-free solid-supported system for Sonogashira couplings: applications in nucleoside chemistry". *CHEMICAL COMMUNICATIONS* (36): 4551-4553 2005
- Adams ML, Johnston ML, Scherer A, Quake SR. "Polydimethylsiloxane based microfluidic diode". *JOURNAL OF MICROMECHANICS AND MICROENGINEERING* 15 (8): 1517-1521 AUG 2005
- Balagadde FK, You LC, Hansen CL, Arnold FH, Quake SR. "Long-term monitoring of bacteria undergoing programmed population control in a microchemostat". *SCIENCE* 309 (5731): 137-140 JUL 1 2005

- Gerton, JM; Wade, LA; Lessard, GA; Ma, Z; Quake, SR. 2004. Tip-enhanced fluorescence microscopy at 10 nanometer resolution. *PHYSICAL REVIEW LETTERS* 93 (18): art. no.-180801.
- Hansen, CL; Sommer, MOA; Quake, SR. 2004. Systematic investigation of protein phase behavior with a microfluidic formulator. *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA* 101 (40): 14431-14436.
- Vyawahare, S; Eyal, S; Mathews, KD; Quake, SR. 2004. Nanometer-scale fluorescence resonance optical waveguides. *NANO LETTERS* 4 (6): 1035-1039.
- Kartalov, EP; Quake, SR. 2004. Microfluidic device reads up to four consecutive base pairs in DNA sequencing-by-synthesis. *NUCLEIC ACIDS RESEARCH* 32 (9): 2873-2879.
- Wade, LA; Shapiro, IR; Ma, ZY; Quake, SR; Collier, CP. 2004. Correlating AFM probe morphology to image resolution for single-wall carbon nanotube tips. *NANO LETTERS* 4 (4): 725-731.
- Hong, JW; Studer, V; Hang, G; Anderson, WF; Quake, SR. 2004. A nanoliter-scale nucleic acid processor with parallel architecture. *NATURE BIOTECHNOLOGY* 22 (4): 435-439.
- Groisman, A; Quake, SR. 2004. A microfluidic rectifier: Anisotropic flow resistance at low Reynolds numbers. *PHYSICAL REVIEW LETTERS* 92 (9): art. no.-094501.
- Rolland, JP; Van Dam, RM; Schorzman, DA; Quake, SR; DeSimone, JM. 2004. Solvent-resistant photocurable "liquid teflon" for microfluidic device fabrication. *JOURNAL OF THE AMERICAN CHEMICAL SOCIETY* 126 (8): 2322-2323.
- Studer, V; Hang, G; Pandolfi, A; Ortiz, M; Anderson, WF; Quake, SR. 2004. Scaling properties of a low-actuation pressure microfluidic valve. *JOURNAL OF APPLIED PHYSICS* 95 (1): 393-398.
- Bao, XYR; Lee, HJ; Quake, SR. 2003. Behavior of complex knots in single DNA molecules. *PHYSICAL REVIEW LETTERS* 91 (26): art. no.-265506.
- C. Hansen and S.R. Quake, "Microfluidics in Structural Biology: Smaller, Faster... Better", *Current Opinion in Structural Biology* 13: 538-544 (2003).
- M.O. Reese, R.M. van Dam, A. Scherer, and S.R. Quake, "Microfabricated Fountain Pens for High-Density DNA Arrays", *Genome Research* 13: 2348-52 (2003).
- J.W. Hong and S.R. Quake, "Integrated Nanoliter Systems", *Nature Biotechnology* 21: 1179-83 (2003).
- J. Liu, C. Hansen and S.R. Quake, "Solving the World-to-Chip Problem with a Microfluidic Matrix", *Anal. Chem.* 75: 4718-23 (2003).
- G.R. Yi, T. Thorsen, V.N. Manoharan, M.J. Hwang, S.J. Jeon, D.J. Pine, S.R. Quake, and S.M. Yang, "Generation of Uniform Colloidal Assemblies in Soft Microfluidic Devices", *Adv. Mater.* 15: 1300-4 (2003).
- A. Groisman, M. Enzelberger, and S.R. Quake, "Microfluidic Logic and Control Devices", *Science*, 300: 955-8 (2003).
- I. Braslavsky, B. Hebert, and S.R. Quake, "Sequence Information Can Be Obtained From Single DNA Molecules", *Proc. Nat'l Acad. Sci.* 100: 3960-4 (2003).

- E.P. Kartalov, M.A. Unger, and S.R. Quake, "Polyelectrolyte surface interface for single molecule fluorescence studies of DNA polymerase", *Biotechniques*, 34, 505-110 (2003).
- M.L. Adams, M. Enzelberger, S. Quake and A. Scherer, "Microfluidic integration on detector arrays for absorption and fluorescence microspectrometers", *Sensors and Actuators A* 104: 25-31 (2003).
- C.L. Hansen, E. Skordalakes, J.M. Berger, and S.R. Quake, "A Robust and Scalable Microfluidic Metering Method that Allows Protein Crystal Growth by Free Interface Diffusion", *Proc. Nat'l Acad. Sci.* 99: 16531-6 (2002).
- T. Thorsen, S.J. Maerkl, and S.R. Quake, "Microfluidic Large Scale Integration", *Science* 298: 580-584 (2002).
- J.P. Brody, B.A. Williams, B.J. Wold, and S.R. Quake, "Significance and Statistical Errors in the Analysis of DNA Microarray Data", *Proc. Nat'l Acad. Sci.* 99: 12975-12978 (2002).
- H.G.R. Thompson, J.W. Harris, B.J. Wold, S.R. Quake and J.P. Brody, "Identification and Confirmation of a Module of Coexpressed Genes", *Genome Research* 12: 1517-1522 (2002).
- C.S. Chiu, K. Jensen, I. Sokolova, D. Wang, M. Li, P. Deshpande, N. Davidson, I. Mody, M.W. Quick, S.R. Quake, and H.A. Lester, "Number, Density, and Surface/Cytoplasmic Distribution of GABA Transporters at Presynaptic Structures of Knock-In Mice Carrying GABA Transporter Subtype 1-Green Fluorescent Protein Transfusions", *Journal of Neuroscience* 22: 10251-66 (2002).
- S. Eyal and S.R. Quake, "Velocity Independent Microfluidic Flow Cytometry", *Electrophoresis* 23: 2653-2657 (2002).
- J. Liu, M. Enzelberger, and S.R. Quake, "A Nanoliter Rotary Device for Polymerase Chain Reaction", *Electrophoresis*, 23: 1531-1536 (2002).
- A. Fu, H. Chou, C. Spence, A. Scherer, F. Arnold and S.R. Quake, "An integrated microfabricated cell sorter", *Analytical Chemistry* 74: 2451-7 (2002).
- M. Van Dam and S. Quake, "Gene Expression Analysis with Universal n-mer Arrays", *Genome Research* 12, 145 (2002).
- H.P. Chou, M. Unger, and S.R. Quake, "A Microfabricated Rotary Pump", *Biomedical Microdevices* 3, 323 (2001).
- T. Thorsen, R. Roberts, F. Arnold, and S. Quake, "Coherent Pattern Formation in a Non-equilibrium Microfluidic Device", *Physical Review Letters* **86**, 4163 (2001).
- S. Quake and A. Scherer, "From Micro to Nano Fabrication with Soft Materials", *Science* **290**, 1526 (2000).
- C.S. Chiu, E. Kartalov, M. Unger, S. Quake and H. Lester, "Single molecule measurements calibrate green fluorescent protein surface densities on transparent beads for use with "knock-in" animals", *Journal of Neuroscience Methods* **105**, 55 (2001).
- J.C. Meiners and S.R. Quake, "FemtoNewton Force Spectroscopy of Single Extended DNA Molecules", *Physical Review Letters* **84**, 5014 (2000).
- M. Unger, H.P. Chou, T. Thorsen, A. Scherer and S. Quake, "Monolithic Microfabricated Valves and Pumps by Multilayer Soft Lithography", *Science* **288**, 113 (2000).

- T.J. Yang, Guillaume Lessard and Stephen R. Quake, “An Apertureless Near Field Microscope for Fluorescence Imaging”, *Applied Physics Letters* **76**, 378 (2000).
- A. Fu, C. Spence, A. Scherer, F. Arnold and S. Quake, “A Microfabricated Fluorescence Activated Cell Sorter”, *Nature Biotechnology* **17**, 1109 (1999).
- M. Unger, E. Kartalov, C.S. Chiu, H. Lester and S. Quake, “Single Molecule Fluorescence Observed with Mercury Lamp Illumination”, *Biotechniques* **27**, 1008 (1999).
- John Hatfield and S.R. Quake, “Dynamic Properties of an Extended Polymer in Solution”, *Phys. Rev. Lett.* **82**, 3548 (1999).
- J.C. Meiners and S.R. Quake, “A Direct Measurement of the Hydrodynamic Interaction Between Two Particles”, *Phys. Rev. Lett.* **82**, 2211 (1999).
- H.P. Chou, C. Spence, A. Scherer and S. Quake, “A Microfabricated Device for Sizing and Sorting DNA Molecules”, *Proc. Nat’l Acad. Sci.* **96**, 11-13 (1999).
- J.P. Brody and S.R. Quake, “A Self-Assembled Microscopic Rotational Probe”, *Appl. Phys. Lett.* **74**, 144-6 (1999).
- Stephen R. Quake, Hazen Babcock and Steven Chu, “The Normal Mode Structure of Extended Single Molecules of DNA”, *Nature* **388**, 151 (1997).
- Stephen R. Quake, “Fast Monte Carlo Algorithms for Knotted Polymers”, *Phys. Rev. E.* **52**, 1176 (1995).
- Stephen R. Quake, “Topological Effects of Knots in Polymers,” *Phys. Rev. Lett.* **73**, 3317 (1994).
- Stephen R. Quake, “The Zimm Model Applied to Extended Single Polymers,” *J. Chem. Phys.* **101**, 4307 (1994).
- Thomas T. Perkins, Stephen R. Quake, Douglas E. Smith and Steven Chu, “Relaxation of a Single Polymer Chain Observed by Optical Microscopy,” *Science* **264**, 822 (1994).

US Patents: (International patents and pending applications not shown)

- 6,964,736 Quake and Volkmuth: Method and apparatus for analysis and sorting of polynucleotides based on size
- 6,960,437 Enzelberger; Markus M.; Liu; Jian; Quake; Stephen R.: Nucleic acid amplification utilizing microfluidic devices
- 6,958,865 Quake; Stephen R.; Brody; James P.: Microlicensing particles and applications
- 6,953,927 Quake; Stephen R.; Lessard; Guillaume; Wade; Lawrence A. (; Gerton; Jordan M.: Method and system for scanning apertureless fluorescence microscope
- 6,947,846 Quake; Stephen R.; van Dam; R. Michael; Brody; James P.; Shafee; Rebecca: Non-metric tool for predicting gene relationships from expression data
- 6,929,030 Unger; Marc A; Chou; Hou-Pu; Thorsen; Todd A; Scherer; Axel; Quake; Stephen R.; Liu; Jian ; Adams; Mark L.; Hansen; Carl L.: Microfabricated elastomeric valve and pump systems
- 6,911,345 Quake; Stephen; Volkmuth; Wayne; Unger; Marc: Methods and apparatus for analyzing polynucleotide sequences

- 6,899,137 Unger; Marc A.; Chou; Hou-Pu; Thorsen; Todd A.; Scherer; Axel; Quake; Stephen R.; Enzelberger; Markus M.; Adams; Mark L.; Hansen; Carl L.: Microfabricated elastomeric valve and pump systems
- 6,841,096 Quake; Stephen R.; Gambin; Yann: Microfabricated lenses, methods of manufacture thereof, and applications therefor
- 6,836,384 Legrand; Olivier; Quake; Stephen R.: Solid immersion lens structures and methods for producing solid immersion lens structures
- 6,833,242 Quake; Stephen R.; Chou; Hou-Pu: Methods for detecting and sorting polynucleotides based on size
- 6,818,395 Quake; Stephen; Unger; Marc: Methods and apparatus for analyzing polynucleotide sequences
- 6,804,062 Atwater; Harry A.; Zhou; Janet Qi; Gambin; Yann; Quake; Stephen R.: Nonimaging concentrator lens arrays and microfabrication of the same
- 6,793,753 Unger; Marc A.; Chou; Hou-Pu; Thorsen; Todd A.; Scherer; Axel; Quake; Stephen R.: Method of making a microfabricated elastomeric valve
- 6,767,706 Quake; Stephen R.; Chou; Hou-Pu: Integrated active flux microfluidic devices and methods
- 6,614,598 Quake; Stephen R.; Brody; James P.: Microlensing particles and applications
- 6,608,726 Legrand; Olivier; Quake; Stephen R.: Solid immersion lens structures and methods for producing solid immersion lens structures
- 6,560,030 Legrand; Olivier; Quake; Stephen R.: Solid immersion lens structures and methods for producing solid immersion lens structures
- 6,540,895 Microfabricated cell sorter for chemical and biological materials
- 6,508,988 Van Dam; R. Michael; Unger; Marc A.; Quake; Stephen R.: Combinatorial synthesis system
- 6,408,878 Unger; Marc A.; Chou; Hou-Pu; Thorsen; Todd A.; Scherer; Axel; Quake; Stephen R.: Microfabricated elastomeric valve and pump systems
- 6,344,325 Quake; Stephen; Volkmuth; Wayne D.: Methods for analysis and sorting of polynucleotides
- 6,301,055 Legrand; Olivier; Quake; Stephen R.: Solid immersion lens structures and methods for producing solid immersion lens structures
- 6,221,654 Quake; Stephen; Volkmuth; Wayne D.: Method and apparatus for analysis and sorting of polynucleotides based on size
- 6,002,471 Quake; Stephen R.: High resolution scanning Raman microscope