



Charles M. Lieber

Email: cml@sz.tsinghua.edu.cn ; cml@smart.org.cn ; liebercharlesm@gmail.com

Website: <https://ibrain.smart.org.cn/>

Personal Data

Date and Place of Birth: 9 April 1959; Philadelphia, PA

Academic Training

Undergraduate: B.A. in Chemistry, Franklin and Marshall College, 1981
Graduate: Ph.D. in Chemistry, Stanford University, 1985
Postgraduate: Postdoctoral Research, California Institute of Technology, 1985-1987

Employment

7/1987–1990 Assistant Professor of Chemistry, Columbia University
1990–6/1991 Associate Professor of Chemistry, Columbia University
7/1991–6/1999 Professor of Chemistry, Harvard University
7/1999–6/2017 Mark Hyman Professor of Chemistry, Harvard University
7/2015–1/2020 Chair, Department of Chemistry and Chemical Biology, Harvard University
7/2017–2/2023 Joshua and Beth Friedman University Professor, Harvard University
2/2023 Retired from Harvard
2/2023–4/2025 Director, Lieber Research Group
4/2025–present: Chair Professor of Tsinghua University, Institute of Materials Research,
Tsinghua Shenzhen International Graduate School
SMART Investigator, Shenzhen Medical Academy of Research and Translation
Director, Institute for Brain Research Advanced Interfaces and Neurotechnologies (*i-BRAIN*)

Academic and Professional Awards

Welch Award in Chemistry (2019); John Gamble Kirkwood Award, Yale University (2018); Director's Pioneer Award, National Institutes of Health (2017 & 2008); MRS Von Hippel Award (2016); Remsen Award (2016); Nano Research Award, Tsinghua University Press/Springer (2013); IEEE Nanotechnology Pioneer Award (2013); Willard Gibbs Medal (2013); Wolf Prize in Chemistry (2012); Fred Kavli Distinguished Lectureship in Nanoscience, Materials Research Society (2010); Friendship Award, People's Republic of China (2009); Inorganic Nanoscience Award, ACS Division of Inorganic Chemistry (2009); Einstein Award, Chinese Academy of Sciences (2008); NBIC Research Excellence Award, University of Pennsylvania (2007); Nanotech Briefs Nano 50 Award (2005); World Technology Award in Materials (2004 & 2003); ACS Award in the Chemistry of Materials (2004); Scientific American 50 Award in Nanotechnology and Molecular Electronics (2003); Nelson W. Taylor Award, Pennsylvania State University (2003); New York Intellectual Property Law Association Inventor of the Year Award (2003); APS McGroddy Prize for New Materials (2003); Harrison Howe Award, University of Rochester (2002); MRS Medal (2002); Foresight Institute Feynman Prize in Nanotechnology (2001); NSF Creativity Award (1996); Leo Hendrik Baekeland Award, American Chemical Society (1995); George Ledlie Prize, Harvard University (1994-1995); MRS Outstanding Young Investigator Award (1993); ACS Award in Pure Chemistry (1992); Denkwalter Prize, Loyola University Chicago (1992); Camille and Henry Dreyfus Teacher-Scholar Award (1990-1995); Alfred P. Sloan Research Fellowship (1990-1992); Wilson Prize (1990); NSF Presidential Young Investigator Award (1988-1993); David and Lucile Packard Fellowship (1988-1993); Distinguished New Faculty Award, Dreyfus Foundation (1987); NIH Postdoctoral Research Fellow (1985-1987); Joseph W. Richards Fellow of the Electrochemical Society (1985); American Institute of Chemists Distinguished Senior Award (1981); Theodore Saulnier Research Award (1981); Pentathlon Medal for Excellence in Chemistry (1981).

Honorary Degrees

Doctor of Science, University of Chicago (2018); Doctor of Science, Honoris Causa, Franklin & Marshall College (2018); Doctor of Science, Union College (2018).

Elected Memberships and Fellowships

Elected Member, European Academy of Engineering (2026); Laureate Distinguished Fellow, International Engineering and Technology Institute (2025); Elected Member, National Academy of Medicine (2017); Elected Foreign Member, Chinese Academy of Science (2015); Elected Member, National Academy of Inventors (2013); Fellow, American Chemical Society, Inaugural Class (2009); Honorary Fellow, Chinese Chemical Society (2009); Elected Fellow, Materials Research Society (2008); Elected Fellow, Institute of Physics (2004); Elected Member, National Academy of Sciences (2004); Elected Fellow, American Academy of Arts and Sciences (2002); Elected Fellow, World Technology Network (2002); Elected Fellow, International Union of Pure and Applied Chemistry (2000); Elected Fellow, American Association for the Advancement of Science (1996); Elected Fellow, American Physical Society (1996).

Honorary Professorships

Nankai University (2014); Institute of Chemistry, Chinese Academy of Sciences (2014); University of Science and Technology Beijing (2011); Peking University (2008); Tsinghua University (2002); University of Science and Technology of China (2002); Fudan University (2002); Zhejiang University (2002).

Research Interests

Chemistry and physics of materials with an emphasis on rational synthesis, hierarchical assembly and fundamental physical properties of nanoscale wires; nano-bioelectronics with a focus on real-time, ultra-sensitive detectors, revolutionary tools for single cell measurements, and three-dimensional innervation of synthetic tissue and organs; brain science with an emphasis on development of the new paradigms for long-term mapping and modulation of neural activity in live animals, studies of fundamental problems in neuroscience, including memory, learning and cognition, and the development of and translation of implants for the treatment of disease. Novel nano-bioelectronic interfaces, brain machine interfaces and the intersection of brain science with artificial intelligence represent active areas of interest expected to impact in significant ways both the treatment human diseases and human intelligence in the future.

Mentoring

Lieber has trained and supported the careers of a large number of graduate students and postdoctoral fellows who in their right are distinguished faculty and scientists at top institutions around the world, including, Duke University, Harvard University, Leiden University, National Center for Nanoscience and Technology, China, Peking University, Seoul National University, Stanford University, Tel-Aviv University, Tsinghua University, UC Berkeley, University of Chicago, and Weizmann Institute of Science. Notably, five (5) of Lieber's former doctoral students are now elected members of the US National Academy of Sciences.

Publications

Lieber has published over 420 articles in peer-reviewed scientific journals. His original work has had a defining influence on the field of nanoscience and nanotechnology, where his publications have been cited overall more than 115,300 times, his top 10 papers have been cited more than 33,400 times, and his h-index (impact factor) is 150. Based on his citation impact scores, Lieber was ranked #1 in Chemistry for the decade 2000-2010 by Thomson Reuters. Publications are as follows:

1. C.M. Lieber, C.M. Gronet and N.S. Lewis, "Evidence against surface state limitations on efficiency of p-Si/CH₃CN junctions," *Nature* **307**, 533-534 (1984).
2. M.L. Rosenbluth, C.M. Lieber and N.S. Lewis, "630-mV open circuit voltage, 12% efficient n-Si liquid junction," *Appl. Phys. Lett.* **45**, 423-425 (1984).
3. C.M. Lieber and N.S. Lewis, "Catalytic reduction of CO₂ at carbon electrodes modified with cobalt phthalocyanine," *J. Am. Chem. Soc.* **106**, 5033-5034 (1984).
4. N.S. Lewis, R. Domingues, C.M. Gronet, C.M. Lieber, M.D. Rosenblum, G.W. Cogan, J.F. Gibbons and G.R. Model, "Design of efficient semiconductor/liquid junction interfaces in nonaqueous solvents," in *The Chemistry and Physics of Electrocatalysis* (eds. J.D.E. McIntyre et al.). The Electrochemical Society: Princeton, 1984).
5. C.M. Lieber and N.S. Lewis, "Probing polymer effects on chemical reactivity: Ligand substitution kinetics of Ru(NH₃)₅(H₂O)²⁺ in Nafion films," *J. Am. Chem. Soc.* **107**, 7190-7191 (1985).
6. C.M. Lieber, M.H. Schmidt and N.S. Lewis, "Reaction entropy measurements for transition-metal ions bound to Nafion-coated electrode surfaces," *J. Phys. Chem.* **90**, 1002-1003 (1986).
7. C.M. Lieber, M.H. Schmidt and N.S. Lewis, "Kinetic studies of ligand substitution rates for the Ru(NH₃)₅(H₂O)²⁺ ion in Nafion films," *J. Am. Chem. Soc.* **108**, 6103-6108 (1986).
8. C.M. Lieber, "Probing polymer induced reactivity effects in modified electrode catalyst systems," *J. Electrochem. Soc.* **133**, 442C-444C (1986).
9. C.M. Lieber, J.L. Karas and H.B. Gray, "Reversible long-range electron transfer in ruthenium-modified sperm whale myoglobin," *J. Am. Chem. Soc.* **109**, 3778-3779 (1987).
10. J.L. Karas, C.M. Lieber and H.B. Gray, "Free energy dependence of the rate of long-range electron transfer in proteins. Reorganization energy in ruthenium-modified myoglobin," *J. Am. Chem. Soc.* **110**, 599-600 (1988).
11. C.M. Lieber, J.L. Karas, S.L. Mayo, A.W. Axup, M. Albin, R.J. Crutchley, W.R. Ellis and H.B. Gray, "Long-range electron transfer in ruthenium-modified metalloproteins," *Trace Elements in Man and Animals 6* (eds. L.S. Hurley and C.L. Keen), Plenum Press: New York, 1988.
12. C.M. Lieber, J.L. Karas, S.L. Mayo, M. Albin and H.B. Gray, "Long-range electron transfer in proteins," in *Proceedings of the Robert A. Welch Foundation Conference on Chemical Research XXXI*, 9-26. Welch Foundation: Houston, 1988.
13. X.-L. Wu and C.M. Lieber, "Determination of the structural and the electronic properties of surfaces using scanning tunneling microscopy coupled with chemical modifications," *J. Am. Chem. Soc.* **110**, 5200-5201 (1988).
14. X.L. Wu, P. Zhou and C.M. Lieber, "Surface electronic properties probed with tunneling microscopy and chemical doping," *Nature* **335**, 55-57 (1988).

15. X.-L. Wu and C.M. Lieber, "In situ imaging of a detergent monolayer using scanning tunneling microscopy," *J. Phys. Chem.* **92**, 5556-5557 (1988).
16. X.-L. Wu, P. Zhou and C.M. Lieber, "Determination of the local effect of impurities on the charge-density-wave phase in TaS₂ by scanning tunneling microscopy," *Phys. Rev. Lett.* **61**, 2604-2607 (1988).
17. X.L. Wu and C.M. Lieber, "Hexagonal domain-like charge density wave phase of TaS₂ determined by scanning tunneling microscopy," *Science* **243**, 1703-1705 (1989).
18. X.L. Wu and C.M. Lieber, "Scanning tunneling microscopy investigations of a new charge density wave phase in niobium-doped tantalum disulfide," *J. Am. Chem. Soc.* **111**, 2731-2733 (1989).
19. S.P. Kelty and C.M. Lieber, "Scanning tunneling microscopy investigations of the electronic structure of potassium-graphite intercalation compounds," *J. Phys. Chem.* **93**, 5983-5985 (1989).
20. S.P. Kelty and C.M. Lieber, "Atomic-resolution scanning-tunneling-microscopy investigations of alkali-metal-graphite intercalation compounds," *Phys. Rev. B* **40**, 5856-5859 (1989).
21. Y. Kim and C.M. Lieber, "Synthesis and characterization of new binuclear electron-transfer models containing rigid aromatic spacers," *Inorg. Chem.* **28**, 3990-3992 (1989).
22. X.L. Wu, C.M. Lieber, D.S. Ginley and R.J. Baughman, "Scanning tunneling microscopy investigations of the local structure of Tl₂Ba₂CaCu₂O₈ single crystals," *Appl. Phys. Lett.* **55**, 2129-2131 (1989).
23. X.L. Wu and C.M. Lieber, "Direct characterization of charge-density-wave defects in titanium-doped TaSe₂ by scanning tunneling microscopy," *Phys. Rev. B* **41**, 1239-1242 (1990).
24. X.L. Wu and C.M. Lieber, "Direct observation of growth and melting of the hexagonal-domain charge-density-wave phase in 1T-TaS₂ by scanning tunneling microscopy," *Phys. Rev. Lett.* **64**, 1150-1153 (1990).
25. H. Chen, X.L. Wu and C.M. Lieber, "Scanning tunneling microscopy investigations of the local electronic and structural effects of iron substitution in tantalum disulfide," *J. Am. Chem. Soc.* **112**, 3326-3332 (1990).
26. X.L. Wu, Z. Zhang, Y.L. Wang and C.M. Lieber, "Structural and electronic role of lead in (PbBi)₂Sr₂CaCu₂O₈ superconductors by STM," *Science* **248**, 1211-1214 (1990).
27. Z. Zhang, Y.L. Wang, X.L. Wu, J.-L. Huang and C.M. Lieber, "Electronic effect of lead substitution in single-crystal Bi(Pb)-Sr-Ca-Cu-O superconductors determined by scanning tunneling microscopy," *Phys. Rev. B* **42**, 1082-1085 (1990).
28. Y.L. Wang, X.L. Wu, C.C. Chen and C.M. Lieber, "Enhancement of the critical current density in single-crystal Bi₂Sr₂CaCu₂O₈ superconductors by chemically induced disorder," *Proc. Natl. Acad. Sci. USA* **87**, 7058-7060 (1990).
29. Y. Kim and C.M. Lieber, "Chemically etched silicon surfaces viewed at the atomic level by force microscopy," *J. Am. Chem. Soc.* **113**, 2333-2335 (1991).
30. X.L. Wu, Y.L. Wang, Z. Zhang and C.M. Lieber, "Electronic and structural effects of oxygen doping in Bi₂Sr₂CaCu₂O_x superconductors characterized by tunneling microscopy," *Phys. Rev. B* **43**, 8729-8732 (1991).
31. X.L. Wu and C.M. Lieber, "Applications of scanning tunneling microscopy to inorganic chemistry," *Prog. Inorg. Chem.* **39**, 431 (1991).

32. S.P. Kelty and C.M. Lieber, "Scanning tunneling microscopy investigations of the surface structure and electronic properties of ternary graphite intercalation compounds," *J. Vac. Sci. Technol. B* **9**, 1068-1071 (1991).
33. X.L. Wu and C.M. Lieber, "Variable-temperature scanning tunneling microscopy studies of the charge density wave phases in tantalum disulfide," *J. Vac. Sci. Technol. B* **9**, 1044 (1991).
34. Z. Zhang and C.M. Lieber, "Scanning tunneling microscopy and spectroscopy studies of the surface structure and electronic properties of single crystal Tl-Ba-Ca-Cu-O superconductors," *J. Vac. Sci. & Technol. B* **9**, 1009 (1991).
35. Z. Zhang, Y.L. Wang, X.L. Wu, J.L. Huang and C.M. Lieber, "The effects of oxygen doping on the electronic properties and microstructure of $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_x$ superconductors determined by scanning tunneling microscopy," *2nd World Congress on Superconductivity* (World Scientific, Teaneck, 1991).
36. H. Dai, H. Chen and C.M. Lieber, "Weak pinning and hexatic order in a doped two-dimensional charge-density-wave system," *Phys. Rev. Lett.* **66**, 3183-3186 (1991).
37. S.P. Kelty, C.C. Chen and C.M. Lieber, "Superconductivity at 30 K in caesium-doped C_{60} ," *Nature* **352**, 223 (1991).
38. C.C. Chen, S.P. Kelty and C.M. Lieber, " $(\text{Rb}_x\text{K}_{1-x})\text{C}_{60}$ Superconductors: formation of a continuous series of solid solutions," *Science* **253**, 886 (1991).
39. C.M. Lieber and X.L. Wu, "Scanning tunneling microscopy studies of low-dimensional materials: probing the effects of chemical substitutions at the atomic level," *Acc. Chem. Res.* **24**, 170 (1991).
40. S.P. Kelty, Z. Lu and C.M. Lieber, "Scanning-tunneling-microscopy investigations of ternary graphite intercalation compounds," *Phys. Rev. B* **44**, 4064-4067 (1991).
41. Y. Kim and C.M. Lieber, "Scanning tunneling microscopy imaging of synthetic oligonucleotides and oligonucleotide-metal complexes," *Scanning Micros.* **5**, 311-316 (1991).
42. S.P. Kelty, Z. Lu and C.M. Lieber, "Core-level binding energies of Cs-doped C_{60} and graphite," *J. Phys. Chem.* **95**, 6754-6756 (1991).
43. Z. Zhang, C.C. Chen, S.P. Kelty, H. Dai and C.M. Lieber, "The superconducting energy gap of Rb_3C_{60} ," *Nature* **353**, 333 (1991).
44. Z. Zhang, C.-C. Chen and C.M. Lieber, "Tunneling spectroscopy of M_3C_{60} superconductors: The energy gap, strong coupling, and superconductivity," *Science* **254**, 1619-1621 (1991).
45. C.M. Lieber and Y. Kim, "Characterization of the structural, electronic, and tribological properties of metal dichalcogenides by scanning probe microscopies," *Thin Solid Films* **206**, 355 (1991).
46. Z. Zhang and C.M. Lieber, "The energy gap of the M_3C_{60} superconductors," *Mod. Phys. Lett. B* **5**, 1905 (1991).
47. Y. Kim, J.-L. Huang and C.M. Lieber, "Characterization of nanometer scale wear and oxidation of transition metal dichalcogenide lubricants by atomic force microscopy," *Appl. Phys. Lett.* **59**, 3404-3406 (1991).
48. Z. Zhang and C.M. Lieber, "Determination of the local structure and electronic states of high- T_c superconductors by scanning tunneling microscopy," *J. Phys. Chem.* **96**, 2030-2038 (1992).

49. Y. Kim, E.C. Long, J. K. Barton and C.M. Lieber, "Imaging of oligonucleotide-metal complexes by scanning tunneling microscopy," *Langmuir* **8**, 496 (1992).
50. Z. Zhang, C.-C. Chen, C.M. Lieber, B. Morosin, D.S. Ginley and E.L. Venturini, "Relationship between crystal chemistry and the local structure and electronic properties of $\text{Tl}_2\text{Ba}_2\text{Ca}_2\text{Cu}_3\text{O}_{10}$ superconductors determined by scanning tunneling microscopy and spectroscopy," *Phys. Rev. B* **45**, 987-992 (1992).
51. S.P. Kelyt and C.M. Lieber, "Scanning tunneling microscopy investigations of graphite intercalation compounds," *CRC Critical Rev. Surf. Sci.* **1(4)**, 217 (1992).
52. C.-C. Chen and C.M. Lieber, "Synthesis of pure $^{13}\text{C}_{60}$ and determination of the isotope effect for fullerene superconductors," *J. Am. Chem. Soc.* **114**, 3141-3142 (1992).
53. C. Niu and C.M. Lieber, "The local structure of $\text{Bi}_{2.2}\text{Sr}_{1.8}\text{Cu}_{1-x}\text{Fe}_x\text{O}_y$ single crystals determined by scanning tunneling microscopy," *J. Phys. Chem.* **96**, 3419-3423 (1992).
54. C. Niu and C.M. Lieber, "Low-temperature growth of the infinite layer phase of SrCuO_2 by pulsed laser deposition," *J. Am. Chem. Soc.* **114**, 3570-3571 (1992).
55. Y. Li, J.L. Huang and C.M. Lieber, "Temperature dependence of the energy gap in $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_8$ superconductors by high-resolution electron-energy-loss spectroscopy," *Phys. Rev. Lett.* **68**, 3240-3243 (1992).
56. Y. Kim and C.M. Lieber, "Machining oxide thin-films with an atomic force microscope: pattern and object formation on the nanometer scale," *Science* **257**, 375-377 (1992).
57. Z. Zhang and C.M. Lieber, "Oxygen doping $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+\delta}$ superconductors: Variations in the BiO -layer electronic states determined by scanning tunneling microscopy," *Phys. Rev. B* **46**, 5845-5848 (1992).
58. H. Dai and C.M. Lieber, "Solid-hexatic-liquid phases in two-dimensional charge-density waves," *Phys. Rev. Lett.* **69**, 1576-1579 (1992).
59. J.-L. Huang, Y.-E. Sung and C.M. Lieber, "Field-induced surface modification on the atomic scale by scanning tunneling microscopy," *Appl. Phys. Lett.* **61**, 1528-1530 (1992).
60. C. Niu and C.M. Lieber, "Growth of the infinite layer phase of $\text{Sr}_{1-x}\text{Nd}_x\text{CuO}_2$ by laser ablation," *Appl. Phys. Lett.* **61**, 1712-1714 (1992).
61. C. Niu and C.M. Lieber, "Exploiting laser based methods for low-temperature solid-state synthesis: Growth of a series of metastable $(\text{Sr}_{1-x}\text{M}_x)_{1-\delta}\text{CuO}_2$ materials," *J. Am. Chem. Soc.* **115**, 137-144 (1993).
62. C.C. Chen and C.M. Lieber, "Isotope effect and superconductivity in metal-doped C_{60} ," *Science* **259**, 655 (1993).
63. Z. Zhang and C.M. Lieber, "Measurement of the energy gap in oxygen-annealed $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_{8+\delta}$ high- T_c superconductors by tunneling spectroscopy," *Phys. Rev. B* **47**, 3423-3426 (1993).
64. H. Dai and C.M. Lieber, "Charge density wave pinning and disorder in two dimensions," *J. Phys. Chem.* **97**, 2362-2367 (1993).
65. Y. Li and C.M. Lieber, "The energy gap in the high- T_c copper oxide superconductors," *Mod. Phys. Lett. B* **7**, 143 (1993).
66. C.M. Lieber and Y. Kim, "Nanomachining and manipulation with the atomic force microscope," *Adv. Mat.* **5**, 392 (1993).

67. Z. Zhang and C.M. Lieber, "Nanotube structure and electronic properties probed by scanning tunneling microscopy," *Appl. Phys. Lett.* **62**, 2792-2794 (1993).
68. Y. Li, J. Liu and C.M. Lieber, "Dependence of the energy gap on T_c : Absence of scaling in the copper oxide superconductors," *Phys. Rev. Lett.* **70**, 3494-3497 (1993).
69. D. Zhang, J.R. Norris, P.J. Krusic, E. Wasserman, C.-C. Chen and C.M. Lieber, "Time-resolved EPR and Fourier transform EPR Study of triplet C_{60} . determinations of T_1 and the ^{13}C hyperfine coupling constant," *J. Phys. Chem.* **97**, 5886-5889 (1993).
70. C. Niu, Y.Z. Lu and C.M. Lieber, "Experimental realization of the covalent solid carbon nitride," *Science* **261**, 334 (1993).
71. H. Dai and C.M. Lieber, "Scanning tunneling microscopy studies of low-dimensional materials: Charge density wave pinning and melting in two dimensions," *Ann. Rev. Phys. Chem.* **44**, 237 (1993).
72. C.M. Lieber, "Modification and manipulation of layered materials using scanned probe microscopies," *The Technology of Proximal Probe Lithography* (ed. C.R.K. Marrian, SPIE Optical Engineering Press, 1993).
73. H. Dai, J. Liu and C.M. Lieber, "Surface pinning and grain boundary formation in magnetic flux-line lattices of $Bi_2Sr_2CaCu_2O_{8+\delta}$ High- T_c superconductors," *Phys. Rev. Lett.* **72**, 748-751 (1994).
74. R. Movshovich, J.D. Thompson, C.-C. Chen and C.M. Lieber, "Pressure dependence of the superconducting transition temperature in nominal $Rb_{0.5}Cs_{2.5}C_{60}$," *Phys. Rev. B* **49**, 3619-3621 (1994).
75. J. Liu, Y. Li and C.M. Lieber, "Intrinsic features of $Bi_2Sr_2CaCu_2O_{8+\delta}$ tunneling spectra: Scaling and symmetry of the energy gap," *Phys. Rev. B* **49**, 6234-6238 (1994).
76. C.M. Lieber and Z. Zhang, "Physical properties of metal-doped fullerene superconductors," *Solid State Physics* **48**, (eds. H. Ehrenreich and F. Spaepen, Academic Press, 1994).
77. C.M. Lieber and C.C. Chen, "Preparation of fullerenes and fullerene based materials," *Solid State Physics* **48**, (eds. H. Ehrenreich and F. Spaepen, Academic Press, 1994).
78. C.M. Lieber, "Scanning tunneling microscopy," *Chem. & Eng. News* **72**, 28 (1994).
79. C.M. Lieber and Z.J. Zhang, "Synthesis of covalent carbon nitride solids: Alternatives to diamond?" *Adv. Mat.* **6**, 497 (1994).
80. S. Yoon, H. Dai, J. Liu and C.M. Lieber, "Surface pinning as a determinant of the bulk flux-Line lattice structure in copper oxide superconductors," *Science* **265**, 215 (1994).
81. S.M. Argentine, A.H. Francis, C.C. Chen, C.M. Lieber and J.S. Siegel, "Unusual photoluminescence behavior of C_{70} ," *J. Phys. Chem.* **98**, 7350-7354 (1994).
82. C. Niu and C.M. Lieber, "Thin film synthesis of solids," *Encyclopedia of Inorganic Chemistry* **8**, 4151-4158 (ed. B. King, John Wiley & Sons, 1994).
83. A.M. Morales, P. Yang and C.M. Lieber, "Preparation of layered $Sr_2CuO_{3+\delta}$ by pulsed laser deposition: Rational synthesis and doping of a metastable copper oxide material," *J. Am. Chem. Soc.* **116**, 8360-8361 (1994).

84. H. Dai, S. Yoon, J. Liu, R.C. Budhani and C.M. Lieber, "Simultaneous observation of columnar defects and magnetic flux lines in high-temperature $\text{Bi}_2\text{Sr}_2\text{CaCu}_2\text{O}_8$ superconductors," *Science* **265**, 1552-1555 (1994).
85. C.D. Frisbie, L.F. Rozsnyai, A. Noy, M.S. Wrighton and C.M. Lieber, "Functional group imaging by chemical force microscopy," *Science* **265**, 2071-2074 (1994).
86. Z. Yao, S. Yoon, H. Dai, S. Fan and C.M. Lieber, "Path of magnetic flux-lines through high- T_c copper oxide superconductors," *Nature* **371**, 777-779 (1994).
87. Z. Zhang and C.M. Lieber, "Characterization of complex materials by scanning tunneling microscopy: A look at superconductors with high critical temperatures," *Materials Chemistry: An Emerging Discipline, Advances in Chemistry Series* 245 (eds. L. Interrante et al., American Chemical Society, 1995).
88. U.C. Täuber, H. Dai, D.R. Nelson and C.M. Lieber, "Coulomb gap and correlated vortex pinning in superconductors," *Phys. Rev. Lett.* **74**, 5132-5135 (1995).
89. Z.J. Zhang, S. Fan and C.M. Lieber, "Growth and composition of covalent carbon nitride solids," *Appl. Phys. Lett.* **66**, 3582-3584 (1995).
90. H. Dai, E.W. Wong, Y.Z. Lu, S. Fan and C.M. Lieber, "Synthesis and characterization of carbide nanorods," *Nature* **375**, 769-772 (1995).
91. A. Noy, C.D. Frisbie, L.F. Rozsnyai, M.S. Wrighton and C.M. Lieber, "Chemical force microscopy: Exploiting chemically-modified tips to quantify adhesion, friction, and functional group distributions in molecular assemblies," *J. Am. Chem. Soc.* **117**, 7943-7951 (1995).
92. C.M. Lieber, "Carbon nitride," *Yearbook of Science and Technology* 40-42 (ed. S. Parker, McGraw-Hill, 1995).
93. S. Yoon, Z. Yao, H. Dai and C.M. Lieber, "Elastic properties of flux-line arrays in high- T_c superconductors probed by two-sided decoration," *Science* **270**, 270-73 (1995).
94. Z.J. Zhang, P. Yang and C.M. Lieber, "Growth and properties of carbon nitride thin films," *Mat. Res. Soc. Symp. Proc.* **388**, 271-80 (1995).
95. C.M. Lieber and Z.J. Zhang, "Carbon nitride solids: Potential alternatives to diamond?" *Chem. Ind.* **22**, 922-25 (1995).
96. Z.J. Zhang, S. Fan, J.L. Huang and C.M. Lieber, "Pulsed laser deposition and physical properties of carbon nitride thin films," *J. Elec. Mater.* **25**, 57-61 (1995).
97. C.M. Lieber, J. Liu and P.E. Sheehan, "Anorganische materialien mit hilfe von rastersondenmikroskopen verstehen und manipulieren," *Angew. Chem. Int. Ed. Ger.* **108**, 748-768 (1996).
98. C.M. Lieber, J. Liu and P.E. Sheehan, "Understanding and manipulating inorganic materials using scanning probe microscopes," *Angew. Chem. Int. Ed. Engl.* **35**, 686-704 (1996).
99. H. Dai, E.W. Wong and C.M. Lieber, "Probing electrical transport in nanomaterials: Conductivity of individual carbon nanotubes," *Science* **272**, 523-526 (1996).
100. Z.J. Zhang, S. Fan, J. Huang and C.M. Lieber, "Diamond-like properties in a single phase carbon nitride solid," *Appl. Phys. Lett.* **68**, 2639-2641 (1996).

101. J. Liu, J.L. Huang and C.M. Lieber, "Probing complex low-dimensional solids with scanning probe microscopes: From charge density waves to high-temperature superconductivity," *J. Vac. Sci. Tech.* **14**, 1064-1069 (1996).
102. Z.J. Zhang, J.L. Huang, S. Fan and C.M. Lieber, "Phases and physical properties of carbon nitride thin films prepared by pulsed laser deposition," *Mat. Sci. & Eng. A* **209**, 5-9 (1996).
103. P.E. Sheehan and C.M. Lieber, "Nanotribology and nanofabrication of MoO₃ structures by force microscopy," *Science* **272**, 1158-61 (1996).
104. J. Liu and C.M. Lieber, "Electron tunneling microscopy: A direct probe of metal substitution in BiSrCaCuO superconductors," *Inorg. Chim. Acta* **243**, 305-308 (1996).
105. C.M. Lieber, E.W. Wong, H. Dai, B.W. Maynor and L.D. Burns, "Growth and structure of carbide nanorods," *Mat. Res. Soc. Symp. Proc.* **410**, 103-112 (1996).
106. E.W. Wong, B.W. Maynor, L.D. Burns and C.M. Lieber, "Growth of metal carbide nanotubes and nanorods," *Chem. Mater.* **8**, 2041-2046 (1996).
107. P. Yang and C.M. Lieber, "Nanorod-superconductor composites: A pathway to high critical current density materials," *Science* **273**, 1836-1840 (1996).
108. C.M. Lieber, "Chemical force microscopy," *Yearbook of Science and Technology* 85-88 (ed. S. Parker, McGraw-Hill, 1996).
109. P.E. Sheehan and C.M. Lieber, "Nanomachining, manipulation and fabrication by force microscopy," *Nanotechnol.* **7**, 236-240 (1996).
110. J. Zhang, J. Liu, J.L. Huang, P. Kim and C.M. Lieber, "Creation of nanocrystals through a solid-solid phase transition induced by an STM tip," *Science* **274**, 757-760 (1996).
111. A.J. Stevens, T. Koga, C.B. Agee, M.J. Aziz and C.M. Lieber, "Stability of carbon nitride materials at high pressure and temperature," *J. Am. Chem. Soc.* **118**, 10900-10901 (1996).
112. P. Kim, Z. Yao and C.M. Lieber, "Structure of vortex arrays by magnetic decoration," *8th IWCC Conf. Proc.* 3-10 (World Scientific, 1996).
113. P. Kim, Z. Yao and C.M. Lieber, "Vortex lattice structure in Bi₂Sr₂CaCu₂O_{8+δ} at high temperatures," *Phys. Rev. Lett.* **77**, 5118-5121 (1996).
114. D.V. Vezenov, A. Noy, L.F. Rozsnyai and C.M. Lieber, "Force titrations and ionization state sensitive imaging of functional groups in aqueous solutions by chemical force microscopy," *J. Am. Chem. Soc.* **119**, 2006-2015 (1997).
115. M.R. Eskildsen, P.L. Gammel, B.P. Barber, U. Yaron, A.P. Ramirez, D.A. Huse, D.J. Bishop, C. Bolle, C.M. Lieber, S. Oxx, S. Sridhar, N.H. Andersen, K. Mortensen and P.C. Canfield, "Observation of a field-driven structural phase transition in the flux line lattice in ErNi₂B₂C," *Phys. Rev. Lett.* **78**, 1968-1971 (1997).
116. J.D. Harper, S.S. Wong, C.M. Lieber and P.T. Lansbury Jr., "Observation of metastable Aβ amyloid protofibrils by atomic force microscopy," *Chem. Biol.* **4**, 119-125 (1997).
117. P. Yang, Z.J. Zhang, J. Hu and C.M. Lieber, "Pulsed laser deposition of diamond-like carbon thin films: Ablation dynamics and growth," *Mater. Res. Soc. Symp. Proc.* **438**, 593-598 (1997).

118. C.M. Lieber, A.M. Morales, P.E. Sheehan, E.W. Wong and P. Yang, "One-dimensional nanostructures: Rational synthesis, novel properties and applications," *Proceedings of the Robert A. Welch Foundation 40th Conference on Chemical Research: Chemistry on the Nanometer Scale* 165-187 (Robert A. Welch Foundation, 1997).
119. P. Yang and C.M. Lieber, "Columnar defect formation in nanorod/ $\text{Tl}_2\text{Ba}_2\text{Ca}_2\text{Cu}_3\text{O}_z$ superconducting composites," *Appl. Phys. Lett.* **70**, 3158-3160 (1997).
120. M.R. Eskildsen, P.L. Gammel, B.P. Barber, A.P. Ramirez, D.J. Bishop, N.H. Andersen, K. Mortensen, C.A. Bolle, C.M. Lieber and P.C. Canfield, "Structural stability of the square flux line lattice in $\text{YNi}_2\text{B}_2\text{C}$ and $\text{LuNi}_2\text{B}_2\text{C}$ studied with small angle neutron scattering," *Phys. Rev. Lett.* **79**, 487-490 (1997).
121. A. Noy, D.V. Vezenov and C.M. Lieber, "Chemical force microscopy," *Annu. Rev. Mater. Sci.* **27**, 381-421 (1997).
122. A. Noy, D. Vezenov, J.F. Kayyem, T.J. Meade and C.M. Lieber, "Stretching and breaking duplex DNA by chemical force microscopy," *Chem. Biol.* **4**, 519-527 (1997).
123. C.M. Lieber, D. Vezenov, A. Noy and C. Sanders, "Chemical force microscopy," *Microscopy and Microanalysis* **3**, 1253-1254 (1997).
124. C.M. Lieber and P. Yang, "High-temperature superconductors," *Science* **277**, 1909-1910 (1997).
125. E.W. Wong, P.E. Sheehan and C.M. Lieber, "Nanobeam mechanics: Elasticity, strength and toughness of nanorods and nanotubes," *Science* **277**, 1971-1975 (1997).
126. J. Zhang, J. Liu, J.L. Huang, P. Kim and C.M. Lieber, "Creation of nanocrystals via a tip-induced solid-solid transformation," *Mater. Res. Soc. Symp. Proc.* **466**, 89-94 (1997).
127. P. Yang and C.M. Lieber, "Nanostructured high-temperature superconductors: Creation of strong-pinning columnar defects in nanorod/superconductor composites," *J. Mater. Res.* **12**, 2981-2996 (1997).
128. J.D. Harper, C.M. Lieber and P. T. Lansbury, "Atomic force microscopic imaging of seeded fibril formation and fibril branching by the Alzheimer's disease amyloid- β protein," *Chem. Biol.* **4**, 951-959 (1997).
129. T. W. Odom, J.L. Huang, P. Kim and C.M. Lieber, "Atomic structure and electronic properties of single-walled carbon nanotubes," *Nature* **391**, 62-64 (1998).
130. A.M. Morales and C.M. Lieber, "A laser ablation method for the synthesis of crystalline semiconductor nanowires," *Science* **279**, 208-211 (1998).
131. S.S. Wong, J.D. Harper, P.T. Lansbury and C.M. Lieber, "Carbon nanotube tips: High-resolution probes for imaging biological systems," *J. Am. Chem. Soc.* **120**, 603-604 (1998).
132. J. Hu, P. Yang and C.M. Lieber, "Nitrogen-driven sp^3 to sp^2 transformation in carbon nitride materials," *Phys. Rev. B* **57**, R3185-R3188 (1998).
133. A. Noy, C.H. Sanders, D.V. Vezenov, S.S. Wong and C.M. Lieber, "Chemically-sensitive imaging in tapping mode by chemical force microscopy: Relationship between phase lag and adhesion," *Langmuir* **14**, 1508-1511 (1998).
134. D.V. Vezenov, A. Noy and C.M. Lieber, "Chemical force microscopy: Probing and imaging interactions between functional groups," *Proceedings of the Scanning Probe Microscopy in Polymers Symposium* 312-320 (American Chemical Society, 1998).

135. J. Hu, P. Yang and C.M. Lieber, "Nitrogen-driven structural transformation in carbon nitride materials," *Appl. Surf. Sci.* **127-129**, 569-573 (1998).
136. S.S. Wong, E. Joselevich, A.T. Woolley, C.L. Cheung and C.M. Lieber, "Covalently functionalized nanotubes as nanometer probes for chemistry and biology," *Nature* **394**, 52-55 (1998).
137. C.M. Lieber, "One-dimensional nanostructures: Chemistry, physics and applications," *Solid State Comm.* **107**, 607-616 (1998).
138. S.S. Wong, A.T. Woolley, E. Joselevich, C.L. Cheung and C.M. Lieber, "Covalently-functionalized single-walled carbon nanotube probe tips for chemical force microscopy," *J. Am. Chem. Soc.* **120**, 8557-8558 (1998).
139. T.W. Odom, J.L. Huang, P. Kim, M. Ouyang and C.M. Lieber, "Scanning tunneling microscopy and spectroscopy studies of single wall carbon nanotubes," *J. Mater. Res.* **13**, 2380-2388 (1998).
140. S.S. Wong, A.T. Woolley, T.W. Odom, J.L. Huang, P. Kim, D.V. Vezenov and C.M. Lieber, "Single-walled carbon nanotube probes for high-resolution nanostructure imaging," *Appl. Phys. Lett.* **73**, 3465-3467 (1998).
141. P. Kim, T.W. Odom, J.-L. Huang and C.M. Lieber, "Electronic density of states of atomically resolved single-walled carbon nanotubes: Van Hove singularities and end states," *Phys. Rev. Lett.* **82**, 1225-1228 (1999).
142. J.H. Hafner, C.L. Cheung and C.M. Lieber, "Growth of nanotubes for probe microscopy tips," *Nature* **398**, 761-762 (1999).
143. J. Hu, M. Ouyang, P. Yang and C.M. Lieber, "Controlled growth and electrical properties of heterojunctions of carbon nanotubes and silicon nanowires," *Nature* **399**, 48-51 (1999).
144. J. Hu, T.W. Odom and C.M. Lieber, "Chemistry and physics in one dimension: Synthesis and properties of nanowires and nanotubes," *Acc. Chem. Res.* **32**, 435-445 (1999).
145. S.S. Wong, A.T. Woolley, E. Joselevich and C.M. Lieber, "Functionalization of carbon nanotube AFM probes using tip-activated gases," *Chem. Phys. Lett.* **306**, 219 (1999).
146. H. Dai, J. Liu and C.M. Lieber, "Elucidating complex charge density wave structures in low-dimensional materials by scanning tunneling microscopy," *Advances in the Crystallographic and Microstructural Analysis of Charge Density Wave Modulated Crystals* (eds. F.W. Boswell and J.C. Bennett, Kluwer Academic, 1998).
147. J.D. Harper, S.S. Wong, C.M. Lieber and P.T. Lansbury, Jr., "Assembly of A β amyloid protofibrils: An *in vitro* model for a possible early event in Alzheimer's disease," *Biochem.* **38**, 8972-8980 (1999).
148. A. Yazdani and C.M. Lieber, "Up close and personal to atoms," *Nature* **401**, 227-230 (1999).
149. J.H. Hafner, C.L. Cheung and C.M. Lieber, "Direct growth of single-walled carbon nanotube scanning probe microscopy tips," *J. Am. Chem. Soc.* **121**, 9750-9751 (1999).
150. J. Wang, K.C. Rose and C.M. Lieber, "Load-independent friction: MoO₃ nanocrystal lubricants," *J. Phys. Chem. B* **103**, 8405-8409 (1999).
151. P. Kim, Z. Yao, C.A. Bolle and C.M. Lieber, "Structure of flux line lattices with weak disorder at large length scales," *Phys. Rev. B* **60**, R12589-R12592 (1999).

152. P. Kim, T.W. Odom, J.L. Huang and C.M. Lieber, "Electronic structures and applications of carbon nanotubes," *Electronic Properties of Novel Materials Science and Technology of Molecular Nanostructures: Xiii International Winterschool* (AIP Conference Proceedings) (eds. H. Kuzmany et al., Springer Verlag, 1999).
153. P. Kim and C.M. Lieber, "Nanotube nanotweezers," *Science* **286**, 2148 - 2150 (1999).
154. L. Venkataraman and C.M. Lieber, "Molybdenum selenide molecular wires as one-dimensional conductors," *Phys. Rev. Lett.* **83**, 5334-5337 (1999).
155. X. Duan and C.M. Lieber, "Laser-assisted catalytic growth of single crystal GaN nanowires," *J. Am. Chem. Soc.* **122**, 188-189 (2000).
156. X. Duan and C.M. Lieber, "General synthesis of compound semiconductor nanowires" *Adv. Mater.* **12**, 298-302 (2000).
157. X. Duan, J. Wang and C.M. Lieber, "Synthesis and optical properties of gallium arsenide nanowires," *Appl. Phys. Lett.* **76**, 1116-1118 (2000).
158. T.W. Odom, J.-L. Huang, P. Kim and C.M. Lieber, "Structure and electronic properties of carbon nanotubes," *J. Phys. Chem. B* **104**, 2794-2809 (2000).
159. C.L. Cheung, J.H. Hafner and C.M. Lieber, "Carbon nanotube atomic force microscopy tips: Direct growth by chemical vapor deposition and application to high-resolution imaging," *Proc. Natl. Acad. Sci. USA* **97**, 3809-3813 (2000).
160. C.L. Cheung, J.H. Hafner, T.W. Odom, K. Kim and C.M. Lieber, "Growth and fabrication with single-walled carbon nanotube probe microscopy tips," *Appl. Phys. Lett.* **76**, 3136-3138 (2000).
161. Q. Wei and C.M. Lieber, "Solution-based synthesis of magnesium oxide nanorods," *Mat. Res. Soc. Symp. Proc.* **581**, 3-7 (2000).
162. Q. Wei and C.M. Lieber, "Synthesis of single crystal bismuth-telluride and lead-telluride nanowires for new thermoelectrical materials," *Mat. Res. Soc. Symp. Proc.* **581**, 219-223 (2000).
163. Y. Cui, X. Duan, J. Hu and C.M. Lieber, "Doping and electrical transport in silicon nanowires," *J. Phys. Chem. B* **104**, 5213-5216 (2000).
164. A.T. Woolley, C. Guillemette, C.L. Cheung, D.E. Housman and C.M. Lieber, "Direct haplotyping of kilobase-size DNA using carbon nanotube probes," *Nat. Biotechnol.* **18**, 760-763 (2000).
165. T. Rueckes, K. Kim, E. Joselevich, G.Y. Tseng, C.L. Cheung and C.M. Lieber, "Carbon nanotube-based nonvolatile random access memory for molecular computing," *Science* **289**, 94-97 (2000).
166. M.S. Gudiksen and C.M. Lieber, "Diameter-selective synthesis of semiconductor nanowires," *J. Am. Chem. Soc.* **122**, 8801-8802 (2000).
167. P.D. Ashby, L. Chen and C.M. Lieber, "Probing intermolecular forces and potentials with magnetic feedback chemical force microscopy," *J. Am. Chem. Soc.* **122**, 9467-9472 (2000).
168. A.T. Woolley, C.L. Cheung, J.H. Hafner and C.M. Lieber, "Structural biology with carbon nanotube AFM probes," *Chem. Biol.* **7**, R193-R204 (2000).
169. T.W. Odom, J.L. Huang, C.L. Cheung and C.M. Lieber, "Magnetic clusters on single-walled carbon nanotubes: The Kondo effect in a one-dimensional host," *Science* **290**, 1549-1552 (2000).

170. P. Kim, J. Zhang and C.M. Lieber, "Charge density wave formation in nanocrystals," *Solid State Physics* (eds. H. Ehrenreich and F. Spaepen, Academic Press, 2000).
171. X. Duan, Y. Huang, Y. Cui, J. Wang and C.M. Lieber, "Indium phosphide nanowires as building blocks for nanoscale electronic and optoelectronic devices," *Nature* **409**, 66-69 (2001).
172. M. Ouyang, J.L. Huang, C.L. Cheung and C.M. Lieber, "Atomically resolved single-walled carbon nanotube intramolecular junctions," *Science* **291**, 97-100 (2001).
173. M. Bockrath, W. Liang, D. Bozovic, J.H. Hafner, C.M. Lieber, M. Tinkham and H. Park, "Resonant electron scattering by defects in single-walled carbon nanotubes," *Science* **291**, 283-285 (2001).
174. Y. Huang, X. Duan, Q. Wei and C.M. Lieber, "Directed assembly of one-dimensional nanostructures into functional networks," *Science* **291**, 630-633 (2001).
175. J.H. Hafner, C.-L. Cheung, T.H. Oosterkamp and C.M. Lieber, "High-yield assembly of individual single-walled carbon nanotube tips for scanning probe microscopies," *J. Phys. Chem. B* **105**, 743-746 (2001).
176. A. Jorio, R. Saito, J.H. Hafner, C.M. Lieber, M. Hunter, T. McClure, G. Dresselhaus and M.S. Dresselhaus, "Structural (n,m) determination of isolated single-wall carbon nanotubes by resonant Raman scattering," *Phys. Rev. Lett.* **86**, 1118-1121 (2001).
177. Y. Cui and C.M. Lieber, "Functional nanoscale electronic devices assembled using silicon nanowire building blocks," *Science* **291**, 851-853 (2001).
178. T.W. Odom, J.H. Hafner and C.M. Lieber, "Scanning probe microscopy studies of carbon nanotubes," *Topics Appl. Phys.* **80**, 173-211 (eds. M.S. Dresselhaus et al., Springer-Verlag, 2001).
179. Y. Cui, L.J. Lauhon, M.S. Gudiksen, J. Wang and C.M. Lieber, "Diameter-controlled synthesis of single-crystal silicon nanowires," *Appl. Phys. Lett.* **78**, 2214-2216 (2001).
180. M. Ouyang, J.L. Huang, C.L. Cheung and C.M. Lieber, "Energy gaps in "metallic" single-walled carbon nanotubes," *Science* **292**, 702-705 (2001).
181. M.S. Gudiksen, J. Wang and C.M. Lieber, "Synthetic control of the diameter and length of single crystal semiconductor nanowires," *J. Phys. Chem. B* **105**, 4062-4064 (2001).
182. D. Bozovic, M. Bockrath, J.H. Hafner, C.M. Lieber, H. Park and M. Tinkham, "Electronic properties of mechanically induced kinks in single-walled carbon nanotubes," *Appl. Phys. Lett.* **78**, 3693-3695 (2001).
183. J.H. Hafner, C.L. Cheung, A.T. Woolley and C.M. Lieber, "Structural and functional imaging with carbon nanotube AFM probes," *Prog. Biophys. Mol. Biol.* **77**, 73-110 (2001).
184. Y. Cui, Q. Wei, H. Park and C.M. Lieber, "Nanowire nanosensors for highly sensitive and selective detection of biological and chemical species," *Science* **293**, 1289-1292 (2001).
185. J. Wang, M.S. Gudiksen, X. Duan, Y. Cui and C.M. Lieber, "Highly polarized photoluminescence and photodetection from single indium phosphide nanowires," *Science* **293**, 1455-1457 (2001).
186. C.M. Lieber, "The incredible shrinking circuit," *Sci. Am.* **285**, 50-56 (2001).
187. Y. Huang, X. Duan, Y. Cui, L. Lauhon, K. Kim and C.M. Lieber, "Logic gates and computation from assembled nanowire building blocks," *Science* **294**, 1313-1317 (2001).

188. G.R. Schnitzler, C.L. Cheung, J.H. Hafner, A.J. Saurin, R.E. Kingston and C.M. Lieber, "Direct imaging of human SWI/SNF remodeled mono- and polynucleosomes by atomic force microscopy employing carbon nanotube tips," *Mol. Cell. Biol.* **21**, 8504-8511 (2001).
189. A. Jorio, A.G. Souza Filho, G. Dresselhaus, M.S. Dresselhaus, R. Saito, J.H. Hafner, C.M. Lieber, F.M. Martinaga, M.S.S. Dantas and M.A. Pimenta, "Joint density of electronic states for one isolated single-wall carbon nanotube studied by resonant Raman scattering," *Phys. Rev. B* **63**, 245416-1 – 245416-4 (2001).
190. A.G. Souza Filho, A. Jorio, J.H. Hafner, C.M. Lieber, R. Saito, M.A. Pimenta, G. Dresselhaus and M.S. Dresselhaus, "Electronic transition energy E_{ii} for an isolated (n,m) single-wall carbon nanotube obtained by anti-Stokes/Stokes resonant Raman intensity ratio," *Phys. Rev. B* **63**, 241404-1 – 241404-4 (2001).
191. M.A. Pimenta, A. Jorio, S.D.M. Brown, A.G. Souza Filho, G. Dresselhaus, J.H. Hafner, C.M. Lieber, R. Saito and M.S. Dresselhaus, "Diameter dependence of the Raman D -band in isolated single-wall carbon nanotubes," *Phys. Rev. B* **64**, 041401-1 – 041401-4 (2001).
192. R. Saito, A. Jorio, J.H. Hafner, C.M. Lieber, M. Hunter, T. McClure, G. Dresselhaus and M.S. Dresselhaus, "Chirality-dependent G-band Raman intensity of carbon nanotubes," *Phys. Rev. B* **64**, 085312-1 – 085312-7 (2001).
193. E.T. Powers, S.I. Yang, C.M. Lieber and J.W. Kelly "Ordered Langmuir-Blodgett films of amphiphilic β -hairpin peptides imaged by atomic force microscopy," *Angew. Chem. Int. Ed.* **41**, 127-130 (2002).
194. M.S. Gudiksen, L.J. Lauhon, J. Wang, D. Smith and C.M. Lieber, "Growth of nanowire superlattice structures for nanoscale photonics and electronics," *Nature* **415**, 617-620 (2002).
195. M. Ouyang, J.-L. Huang and C.M. Lieber, "One-dimensional energy dispersion of single-walled carbon nanotubes by resonant electron scattering," *Phys. Rev. Lett.* **88**, 066804-1 – 066804-4 (2002).
196. C.M. Lieber, "Nanowire superlattices," *Nano Lett.* **2**, 81-82 (2002).
197. Y. Huang, X. Duan, Y. Cui and C.M. Lieber, "Gallium nitride nanowire nanodevices," *Nano Lett.* **2**, 101-104 (2002).
198. T.W. Odom, J.L. Huang and C.M. Lieber, "STM studies of single-walled carbon nanotubes," *J. Phys.: Condensed Matter* **14**, R145-R167 (2002).
199. C.L. Cheung, A. Kurtz, H. Park and C.M. Lieber, "Diameter-controlled synthesis of carbon nanotubes," *J. Phys. Chem. B* **106**, 2429-2433 (2002).
200. L. Chen, K.A. Haushalter, C.M. Lieber and G.L. Verdine, "Direct visualization of a DNA glycosylase searching for damage," *Chem. Biol.* **9**, 345-350 (2002).
201. M.S. Gudiksen, J. Wang and C.M. Lieber, "Size-dependent photoluminescence from single indium phosphide nanowires," *J. Phys. Chem. B* **106**, 4036-4039 (2002).
202. X. Duan, Y. Huang, Y. Cui and C.M. Lieber, "Nonvolatile memory and programmable logic from molecule-gated nanowires," *Nano Lett.* **2**, 487-490 (2002).
203. M. Ouyang, J.L. Huang and C.M. Lieber, "Scanning tunneling microscopy studies of the one-dimensional electronic properties of single-walled carbon nanotubes," *Annu. Rev. Phys. Chem.* **53**, 201-220 (2002).
204. T.W. Odom, J. Huang and C.M. Lieber, "Single-walled carbon nanotubes. From fundamental studies to new device concepts," *Ann. N. Y. Acad. Sci.* **960**, 203-215 (2002).

205. D.V. Vezenov, A.V. Zhuk, G.M. Whitesides and C.M. Lieber, "Chemical force spectroscopy in heterogeneous systems: Intermolecular interactions involving epoxy polymer, mixed monolayers, and polar solvents," *J. Am. Chem. Soc.* **124**, 10578-10588 (2002).
206. C.M. Lieber, "Nanoscience and nanotechnology: Building a big future from small things," *Update* 6-9 (New York Academy of Sciences, October 2002).
207. L.J. Lauhon, M.S. Gudiksen, D. Wang and C.M. Lieber, "Epitaxial core-shell and core-multi-shell nanowire heterostructures," *Nature* **420**, 57-61 (2002).
208. E. Joselevich and C.M. Lieber, "Vectorial growth of metallic and semiconducting single-wall carbon nanotubes" *Nano Lett.* **2**, 1137-1141 (2002).
209. M. Ouyang, J.L. Huang and C.M. Lieber, "Fundamental electronic properties and applications of single-walled carbon nanotubes" *Acc. Chem. Res.* **35**, 1018-1025 (2002).
210. A.G. Souza Filho, A. Jorio, G. Dresselhaus, M.S. Dresselhaus, R. Saito, A.K. Swan, M.S. Unlu, B.B. Goldberg, J.H. Hafner, C.M. Lieber and M.A. Pimenta "Effect of quantized electronic states on the dispersive Raman features in individual single-wall carbon nanotubes," *Phys. Rev B: Condens. Matter Mater. Phys.* **65**, 035404/1-035404/6 (2002).
211. A.G. Souza Filho, A. Jorio, A.K. Swan, M.S. Unlu, B.B. Goldberg, R. Saito, J.H. Hafner, C.M. Lieber, M.A. Pimenta, G. Dresselhaus and M.S. Dresselhaus "Anomalous two-peak G'-band Raman effect in one isolated single-wall carbon nanotube," *Phys. Rev B: Condens. Matter Mater. Phys.* **65**, 085417/1-035404/8 (2002).
212. A.G. Souza Filho, A. Jorio, G.G. Samsonidze, G. Dresselhaus, M.S. Dresselhaus, A.K. Swan, M.S. Unlu, B.B. Goldberg, R. Saito, J.H. Hafner, C.M. Lieber and M.A. Pimenta "Probing the electronic trigonal warping effect in individual single-wall carbon nanotubes using phonon spectra," *Chem. Phys Lett.* **354**, 62-68 (2002).
213. A. Jorio, A.G. Souza Filho, V.W. Brar, A.K. Swan, M.S. Unlu, B.B. Goldberg, A. Righi, J.H. Hafner, C.M. Lieber, R. Saito, G. Dresselhaus and M.S. Dresselhaus "Polarized resonant Raman study of isolated single-wall carbon nanotubes: Symmetry selection rules, dipolar and multipolar antenna effects," *Phys. Rev B: Condens. Matter Mater. Phys.* **65**, 121402/1-035404/4 (2002).
214. A. Jorio, A.G. Souza Filho, G. Dresselhaus, M.S. Dresselhaus, A.K. Swan, M.S. Unlu, B.B. Goldberg, M.A. Pimenta, J.H. Hafner, C.M. Lieber and R. Saito "G-band resonant Raman study of 62 isolated single-wall carbon nanotubes," *Phys. Rev B: Condens. Matter Mater. Phys.* **65**, 155412/1-155412/9 (2002).
215. A.G. Souza Filho, A. Jorio, G. Dresselhaus, M.S. Dresselhaus, A.K. Swan, M.S. Unlu, B.B. Goldberg, J.H. Hafner, C.M. Lieber, M.A. Pimenta and R. Saito "Dependence of the second-order G'-band profile on the electronic structure of single-wall nanotubes," *Mater. Res. Soc. Symp. Proc.* **706**, 181-186 (2002).
216. A. Jorio, A.G. Souza Filho, G. Dresselhaus, M.S. Dresselhaus, A.K. Swan, M.S. Unlu, B.B. Goldberg, M.A. Pimenta, J.H. Hafner, C.M. Lieber and R. Saito, "G-band Raman spectra of isolated single wall carbon nanotubes: Diameter and chirality dependence," *Mater. Res. Soc. Symp. Proc.* **706**, 187-192 (2002).
217. A. Jorio, F.M. Matinaga, A. Righi, M.S.S. Dantas, M.A. Pimenta, A.G. Souza Filho, J. Mendes Filho, J.H. Hafner, C.M. Lieber, R. Saito, G. Dresselhaus and M.S. Dresselhaus, "Resonance Raman scattering: Nondestructive and noninvasive technique for structural and electronic characterization of isolated single-wall carbon nanotubes," *Brazilian J. Phys.* **32**, 921-924 (2002).
218. X. Duan, Y. Huang, R. Agarwal and C.M. Lieber, "Single-nanowire electrically driven lasers," *Nature* **421**, 241-245 (2003).

219. Y. Cui, Z. Zhong, D. Wang, W.U. Wang and C.M. Lieber, "High performance silicon nanowire field effect transistors," *Nano Lett.* **3**, 149-152 (2003).
220. X. Duan, Y. Huang and C.M. Lieber, "Nanowire nanocircuits," *McGraw-Hill Yearbook of Science and Technology* 272-276 (eds. M.D. Licker et al., McGraw-Hill, 2003).
221. Z. Zhong, F. Qian, D. Wang and C.M. Lieber, "Synthesis of p-type gallium nitride nanowires for electronic and photonic nanodevices," *Nano Lett.* **3**, 343-346 (2003).
222. M.C. McAlpine, R.S. Friedman and C.M. Lieber, "Nanoimprint lithography for hybrid plastic electronics," *Nano Lett.* **3**, 443-445 (2003).
223. D. Wang and C.M. Lieber, "Inorganic materials: Nanocrystals branch out," *Nat. Mater.* **2**, 355-356 (2003).
224. X. Duan, Y. Huang, Y. Cui and C.M. Lieber, "Nanowire nanoelectronics assembled from the bottom-up" *Molecular Nanoelectronics* 199-227 (eds. M.A. Reed and T. Lee, American Scientific, 2003).
225. D. Whang, S. Jin and C.M. Lieber, "Nanolithography using hierarchically assembled nanowire masks," *Nano Lett.* **3**, 951-954 (2003).
226. C.M. Lieber, "Nanoscale science and technology: Building a big future from small things," *MRS Bull.* **28**, 486-491 (2003).
227. C.J. Barrelet, Y. Wu, D.C. Bell and C.M. Lieber, "Synthesis of CdS and ZnS nanowires using single-source molecular precursors," *J. Am. Chem. Soc.* **125**, 11498-11499 (2003).
228. D. Whang, S. Jin, Y. Wu and C.M. Lieber, "Large-scale hierarchical organization of nanowire arrays for integrated nanosystems," *Nano Lett.* **3**, 1255-1259 (2003).
229. Y. Cui, X. Duan, Y. Huang and C.M. Lieber, "Nanowires as building blocks for nanoscale science and technology," *Nanowires and Nanobelts – Materials, Properties and Devices* 3-68 (ed. Z.L. Wang, Kluwer Academic/Plenum, 2003).
230. M.C. McAlpine, R.S. Friedman, S. Jin, K. Lin, W.U. Wang and C.M. Lieber, "High-performance nanowire electronics and photonics on glass and plastic substrates," *Nano Lett.* **3**, 1531-1535 (2003).
231. Z. Zhong, D. Wang, Y. Cui, M.W. Bockrath and C.M. Lieber, "Nanowire crossbar arrays as address decoders for integrated nanosystems," *Science* **302**, 1377-1379 (2003).
232. D. Bozovic, M. Bockrath, J.H. Hafner, C.M. Lieber, H. Park and M. Tinkham, "Plastic deformations in mechanically strained single-walled carbon nanotubes," *Phys. Rev. B* **67**, 033407/1-033407/4 (2003).
233. D.V. Vezenov, A. Noy and C.M. Lieber, "The effect of liquid-induced adhesion changes on the interfacial shear strength between self-assembled monolayers," *J. Adhesion Sci. Technol.* **17**, 1385-1401 (2003).
234. M.M. Ziegler, C.A. Picconatto, J.C. Ellenbogen, A. DeHon, D. Wang, Z. Zhong and C.M. Lieber, "Scalability simulations for nanomemory systems integrated on the molecular scale," *Ann. N.Y. Acad. Sci.* **1006**, 312-330 (2003).
235. J. Hahm and C.M. Lieber, "Direct ultrasensitive electrical detection of DNA and DNA sequence variations using nanowire nanosensors," *Nano Lett.* **4**, 51-54 (2004).
236. Y. Wu, Y. Cui, L. Huynh, C.J. Barrelet, D.C. Bell and C.M. Lieber, "Controlled growth and structures of molecular-scale silicon nanowires," *Nano Lett.* **4**, 433-436 (2004).

237. D. Wang, F. Qian, C. Yang, Z. Zhong and C.M. Lieber, "Rational growth of branched and hyperbranched nanowire structures," *Nano Lett.* **4**, 871-874 (2004).
238. S. Jin, D. Whang, M.C. McAlpine, R.S. Friedman, Y. Wu and C.M. Lieber, "Scalable interconnection and integration of nanowire devices without registration," *Nano Lett.* **4**, 915-919 (2004).
239. A.B. Greytak, L.J. Lauhon, M.S. Gudiksen and C.M. Lieber, "Growth and transport properties of complementary germanium nanowire field-effect transistors," *Appl. Phys. Lett.* **84**, 4176-4178 (2004).
240. L.J. Lauhon, M.S. Gudiksen and C.M. Lieber, "Semiconductor nanowire heterostructures," *Phil. Trans. R. Soc. Lond. A* **362**, 1247-1260 (2004).
241. Y. Wu, J. Xiang, C. Yang, W. Lu and C.M. Lieber, "Single-crystal metallic nanowires and metal/semiconductor nanowire heterostructures," *Nature* **430**, 61-65 (2004).
242. D. Whang, S. Jin and C.M. Lieber, "Large-scale hierarchical organization of nanowires for functional nanosystems," *Japanese J. Appl. Phys.* **43**, 4465-4470 (2004).
243. D.C. Bell, Y. Wu, C.J. Barrelet, S. Gradečak, J. Xiang, B.P. Timko and C.M. Lieber, "Imaging and analysis of nanowires," *Microscop. Res. Tech.* **64**, 373-389 (2004).
244. L. Chen, C.L. Cheung, P.D. Ashby and C.M. Lieber, "Single-walled carbon nanotube AFM probes: Optimal imaging resolution of nanoclusters and biomolecules in ambient and fluid environments," *Nano Lett.* **4**, 1725-1731 (2004).
245. F. Patolsky, G. Zheng, O. Hayden, M. Lakadamyali, X. Zhuang and C.M. Lieber, "Electrical detection of single viruses," *Proc. Natl. Acad. Sci. USA* **101**, 14017-14022 (2004).
246. F. Qian, Y. Li, S. Gradečak, D. Wang, C.J. Barrelet and C.M. Lieber, "Gallium nitride-based nanowire radial heterostructures for nanophotonics," *Nano Lett.* **4**, 1975-1979 (2004).
247. C.J. Barrelet, A.B. Greytak and C.M. Lieber, "Nanowire photonic circuit elements," *Nano Lett.* **4**, 1981-1985 (2004).
248. G. Zheng, W. Lu, S. Jin and C.M. Lieber, "Synthesis and fabrication of high-performance n-type silicon nanowire transistors," *Adv. Mater.* **16**, 1890-1893 (2004).
249. Y. Huang and C.M. Lieber, "Integrated nanoscale electronics and optoelectronics: Exploring nanoscale science and technology through semiconductor nanowires," *Pure Appl. Chem.* **76**, 2051-2068 (2004).
250. P.D. Ashby and C.M. Lieber, "Brownian force profile reconstruction of interfacial 1-nonanol solvent structure," *J. Am. Chem. Soc.* **126**, 16973-16980 (2004).
251. Y. Huang, X. Duan and C.M. Lieber, "Nanowires for integrated multicolor nanophotonics," *Small* **1**, 142-147 (2005).
252. W.U. Wang, C. Chen, K. Lin, Y. Fang and C.M. Lieber, "Label-free detection of small-molecule-protein interactions by using nanowire nanosensors," *Proc. Natl. Acad. Sci. USA* **102**, 3208-3212 (2005).
253. F. Patolsky and C.M. Lieber, "Nanowire nanosensors," *Materials Today* **8**, 20-28 (2005).
254. Y. Huang, X. Duan and C.M. Lieber, "Semiconductor nanowires: Nanoscale electronics and optoelectronics," *Dekker Encyclopedia of Nanoscience and Nanotechnology* (ed. J.A. Schwarz, Marcel Dekker, Inc., 2005).

255. X. Duan and C.M. Lieber, "Semiconductor nanowires: rational synthesis," *Dekker Encyclopedia of Nanoscience and Nanotechnology* (ed. J.A. Schwarz, Marcel Dekker, Inc., 2005).
256. R.S. Friedman, M.C. McAlpine, D.S. Ricketts, D. Ham and C.M. Lieber, "High-speed integrated nanowire circuits," *Nature* **434**, 1085 (2005).
257. R. Agarwal, C.J. Barrelet and C.M. Lieber, "Lasing in single cadmium sulfide nanowire optical cavities," *Nano Lett.* **5**, 917-920 (2005).
258. P.D. Ashby and C.M. Lieber, "Ultra-sensitive imaging and interfacial analysis of patterned hydrophilic SAM surfaces using energy dissipation chemical force microscopy," *J. Am. Chem. Soc.* **127**, 6814-6818 (2005).
259. Z. Zhong, Y. Fang, W. Lu and C.M. Lieber, "Coherent single charge transport in molecular-scale silicon nanowires," *Nano Lett.* **5**, 1143-1146 (2005).
260. M.C. McAlpine, R.S. Friedman and C.M. Lieber, "High-performance nanowire electronics and photonics and nanoscale patterning on flexible plastic substrates," *Proc. IEEE* **93**, 1357-1363 (2005).
261. W. Lu, J. Xiang, B.P. Timko, Y. Wu and C.M. Lieber, "One-dimensional hole gas in germanium/silicon nanowire heterostructures," *Proc. Natl. Acad. Sci. USA* **102**, 10046-10051 (2005).
262. P.V. Radovanovic, C.J. Barrelet, S. Gradečak, F. Qian and C.M. Lieber, "General synthesis of manganese-doped II-VI and III-V semiconductor nanowires," *Nano Lett.* **5**, 1407-1411 (2005).
263. G. Zheng, F. Patolsky, Y. Cui, W.U. Wang and C.M. Lieber, "Multiplexed electrical detection of cancer markers with nanowire sensor arrays," *Nat. Biotechnol.* **23**, 1294-1301 (2005).
264. A.B. Greytak, C.J. Barrelet, Y. Li and C.M. Lieber, "Semiconductor nanowire laser and nanowire waveguide electro-optic modulators," *Appl. Phys. Lett.* **87**, 151103-1 - 151103-3 (2005).
265. S. Gradečak, F. Qian, Y. Li, H.-G. Park and C.M. Lieber, "GaN nanowire lasers with low lasing thresholds," *Appl. Phys. Lett.* **87**, 173111-1 -173111-3 (2005).
266. R. Agarwal, K. Ladavac, Y. Roichman, G. Yu, C.M. Lieber and D.G. Grier, "Manipulation and assembly of nanowires with holographic optical traps," *Opt. Express* **13**, 8906-8912 (2005).
267. F. Qian, S. Gradečak, Y. Li, C. Wen and C.M. Lieber, "Core/multishell nanowire heterostructures as multicolor, high-efficiency light-emitting diodes," *Nano Lett.* **5**, 2287-2291 (2005).
268. C. Yang, Z. Zhong and C.M. Lieber, "Encoding electronic properties by synthesis of axial modulation doped silicon nanowires," *Science* **310**, 1304-1307 (2005).
269. C.J. Barrelet, J. Bao, M. Loncar, H.-G. Park, F. Capasso and C.M. Lieber, "Hybrid single-nanowire photonic crystal and microresonator structures," *Nano Lett.* **6**, 11-15 (2006).
270. J.E. Savage, E. Rachlin, A. DeHon, C.M. Lieber and Y. Wu, "Radial addressing of nanowires," *J. Emerg. Technol. Comput. Syst.* **2**, 129-154 (2006).
271. O. Hayden, R. Agarwal and C.M. Lieber, "Nanoscale avalanche photodiodes for highly-sensitive and spatially-resolved photon detection," *Nat. Mater.* **5**, 352-356 (2006).
272. J. Xiang, W. Lu, Y. Hu, Y. Wu, H. Yan and C.M. Lieber, "Ge/Si nanowire heterostructures as high-performance field-effect transistors," *Nature* **441**, 489-493 (2006).

273. F. Patolsky, G. Zheng and C.M. Lieber, "Nanowire sensors for medicine and the life sciences," *Nanomedicine* **1**, 51-65 (2006).
274. Y. Li, J. Xiang, F. Qian, S. Gradečak, Y. Wu, H. Yan, D.A. Blom and C.M. Lieber, "Dopant-free GaN/AlN/AlGaN radial nanowire heterostructures as high electron mobility transistors," *Nano Lett.* **6**, 1468-1473 (2006).
275. F. Patolsky, G. Zheng and C.M. Lieber, "Nanowire-based biosensors," *Anal. Chem.* **78**, 4260-4269 (2006).
276. F. Patolsky, B.P. Timko, G. Yu, Y. Fang, A.B. Greytak, G. Zheng and C.M. Lieber, "Detection, stimulation, and inhibition of neuronal signals with high-density nanowire transistor arrays," *Science* **313**, 1100-1104 (2006).
277. Y. Li, F. Qian, J. Xiang and C.M. Lieber, "Nanowire electronic and optoelectronic devices," *Materials Today* **9**, 18-27 (2006).
278. R. Agarwal and C.M. Lieber, "Semiconductor nanowires: optics and optoelectronics," *Appl. Phys. A: Mater. Sci. Proc.* **85**, 209-215 (2006).
279. F. Patolsky, G. Zheng and C.M. Lieber, "Fabrication of silicon nanowire devices for ultrasensitive, label-free, real-time detection of biological and chemical species," *Nat. Protocols* **1**, 1711-1724 (2006).
280. W. Lu and C.M. Lieber, "Semiconductor nanowires," *J. Phys. D: Appl. Phys.* **39**, R387-R406 (2006).
281. C. Yang, C.J. Barrelet, F. Capasso and C.M. Lieber, "Single p-type/intrinsic/n-type silicon nanowires as nanoscale avalanche photodetectors," *Nano Lett.* **6**, 2929-2934 (2006).
282. J. Xiang, A. Vidan, M. Tinkham, R.M. Westervelt and C.M. Lieber, "Ge/Si nanowire mesoscopic Josephson junctions," *Nat. Nanotechnol.* **1**, 208-213 (2006).
283. C.M. Lieber and Z.L. Wang, "Functional nanowires," *MRS Bull.* **32**, 99-104 (2007).
284. F. Patolsky, B.P. Timko, G. Zheng and C.M. Lieber, "Nanowire-based nanoelectronic devices in the life sciences," *MRS Bull.* **32**, 142-149 (2007).
285. G. Liang, J. Xiang, N. Kharche, G. Klimeck, C.M. Lieber and M. Lundstrom, "Performance analysis of a Ge/Si core/shell nanowire field-effect transistor," *Nano Lett.* **7**, 642-646 (2007).
286. A. Javey, S. Nam, R.S. Friedman, H. Yan and C.M. Lieber, "Layer-by-layer assembly of nanowires for three-dimensional, multifunctional electronics," *Nano Lett.* **7**, 773-777 (2007).
287. G. Yu, A. Cao and C.M. Lieber, "Large-area blown bubble films of aligned nanowires and carbon nanotubes," *Nat. Nanotechnol.* **2**, 372-377 (2007).
288. C.M. Lieber, "The incredible shrinking circuit," *Sci. Am. Special Ed.* **17**, 64-71 (2007).
289. X. Jiang, Q. Xiong, S. Nam, F. Qian, Y. Li and C.M. Lieber, "InAs/InP radial nanowire heterostructures as high electron mobility devices," *Nano Lett.* **7**, 3214-3218 (2007).
290. Y. Hu, H.O.H. Churchill, D.J. Reilly, J. Xiang, C.M. Lieber and C.M. Marcus, "A Ge/Si heterostructure nanowire-based double quantum dot with integrated charge sensor," *Nat. Nanotechnol.* **2**, 622-625 (2007).
291. B. Tian, X. Zheng, T.J. Kempa, Y. Fang, N. Yu, G. Yu, J. Huang and C.M. Lieber, "Coaxial silicon nanowires as solar cells and nanoelectronic power sources," *Nature* **449**, 885-890 (2007).

292. W. Lu and C.M. Lieber, "Nanoelectronics from the bottom up," *Nat. Mater.* **6**, 841-850 (2007).
293. O. Hayden, G. Zheng, P. Agarwal and C.M. Lieber, "Visualization of carrier depletion in semiconducting nanowires," *Small* **3**, 2048-2052 (2007).
294. Z. Zhong, C. Yang and C.M. Lieber, "Silicon nanowires and nanowire heterostructures," *Nanosilicon* 176-216 (ed. V. Kumar, Elsevier, 2008).
295. A. Noy, D.V. Vezenov and C.M. Lieber, "Chemical force microscopy nanoscale probing of fundamental chemical interactions," *Handbook of Molecular Force Spectroscopy* 97-122 (ed. A. Noy, Springer, 2008).
296. D.V. Vezenov, A. Noy and C.M. Lieber, "Chemical force microscopy: Force spectroscopy and imaging of complex interactions in molecular assemblies," *Handbook of Molecular Force Spectroscopy* 123-141 (ed. A. Noy, Springer, 2008).
297. Y. Dong, G. Yu, M.C. McAlpine, W. Lu and C.M. Lieber, "Si/a-Si Core/Shell Nanowires as Nonvolatile Crossbar Switches," *Nano Lett.* **8**, 386-391 (2008).
298. G. Yu, X. Li, C.M. Lieber and A. Cao, "Nanomaterial-incorporated blown bubble films for large-area, aligned nanostructures," *J. Mater. Chem.* **18**, 728-734 (2008).
299. Y. Hu, J. Xiang, G. Liang, H. Yan and C.M. Lieber, "Sub-100 nanometer channel length Ge/Si nanowire transistors with potential for 2 THz switching speed," *Nano Lett.* **8**, 925-930 (2008).
300. C. Wang, Y. Hu, C.M. Lieber and S. Sun, "Ultrathin Au nanowires and their transport properties," *J. Am. Chem. Soc.* **130**, 8902-8903 (2008).
301. W.I. Park, G. Zheng, X. Jiang, B. Tian and C.M. Lieber, "Controlled synthesis of millimeter-long silicon nanowires with uniform electronic properties," *Nano Lett.* **8**, 3004-3009 (2008).
302. F. Qian, Y. Li, S. Gradečak, H.-G. Park, Y. Dong, Y. Ding, Z.L. Wang and C.M. Lieber, "Multi-quantum-well nanowire heterostructures for wavelength-controlled lasers," *Nat. Mater.* **7**, 701-706 (2008).
303. H.-G. Park, C.J. Barrelet, Y. Wu, B. Tian, F. Qian and C.M. Lieber, "A wavelength-selective photonic-crystal waveguide coupled to a nanowire light source," *Nat. Photonics* **2**, 622-626 (2008).
304. T.J. Kempa, B. Tian, D.R. Kim, J. Hu, X. Zheng and C.M. Lieber, "Single and tandem axial p-i-n nanowire photovoltaic devices," *Nano Lett.* **8**, 3456-3460 (2008).
305. S. Roddaro, A. Fuhrer, P. Brusheim, C. Fasth, H.Q. Xu, L. Samuelson, J. Xiang and C.M. Lieber, "Spin states of holes in Ge/Si nanowire quantum dots," *Phys. Rev. Lett.* **101**, 186802-1 – 186802-4 (2008).
306. W. Lu, P. Xie and C.M. Lieber, "Nanowire transistor performance limits and applications," *IEEE Trans. Electron Dev.* **55**, 2859-2876 (2008).
307. B. Tian, T.J. Kempa and C.M. Lieber, "Single nanowire photovoltaics," *Chem. Soc. Rev.* **38**, 16-24 (2009).
308. B.P. Timko, T. Cohen-Karni, G. Yu, Q. Qing, B. Tian and C.M. Lieber, "Electrical recording from hearts with flexible nanowire device arrays," *Nano Lett.* **9**, 914-918 (2009).
309. F.A. Zwanenburg, C.E.W.M. van Rijmenam, Y. Fang, C.M. Lieber and L.P. Kouwenhoven, "Spin states of the first four holes in a silicon nanowire quantum dot," *Nano Lett.* **9**, 1071-1079 (2009).

310. T. Cohen-Karni, B.P. Timko, L.E. Weiss and C.M. Lieber, "Flexible electrical recording from cells using nanowire transistor arrays," *Proc. Natl. Acad. Sci. USA* **106**, 7309-7313 (2009).
311. Y. Dong, B. Tian, T. Kempa and C.M. Lieber, "Coaxial group III-nitride nanowire photovoltaics," *Nano Lett.* **9**, 2183-2187 (2009).
312. S. Vandenbrouck, K. Madjour, D. Théron, Y.J. Dong, Y. Li, C.M. Lieber and C. Gaquiere, "12 GHz F_{MAX} GaN/AlN/AlGaIn nanowire MISFET," *IEEE Electron Dev. Lett.* **30**, 322-324 (2009).
313. F.A. Zwanenburg, A.A. van Loon, G.A. Steele, C.E.W.M. van Rijmenam, T. Balder, L.P. Kouwenhoven, Y. Fang and C.M. Lieber, "Ultra-small silicon quantum dots," *J. Appl. Phys.* **105**, 124314-1 (2009).
314. P. Xie, Y. Hu, Y. Fang, J. Huang and C.M. Lieber, "Diameter-dependent dopant location in silicon and germanium nanowires," *Proc. Natl. Acad. Sci. USA* **106**, 15254-15258 (2009).
315. S.K. Lim, M. Brewster, F. Qian, Y. Li, C.M. Lieber and S. Gradečak, "Direct correlation between structural and optical properties of III-V nitride nanowire heterostructures with nanoscale resolution," *Nano Lett.* **9**, 3940-3944 (2009).
316. B. Tian, P. Xie, T.J. Kempa, D.C. Bell and C.M. Lieber, "Single crystalline kinked semiconductor nanowire superstructures," *Nat. Nanotechnol.*, **4**, 824-829 (2009).
317. S.W. Nam, X. Jiang, Q. Xiong, D. Ham and C.M. Lieber, "Vertically integrated, three-dimensional nanowire complementary metal-oxide-semiconductor circuits," *Proc. Natl. Acad. Sci. USA*, **106**, 21035-21038 (2009).
318. N.A. Kotov, J.O. Winter, I.P. Clements, E. Jan, B.P. Timko, S. Campidelli, S. Pathak, A. Mazzatenta, C.M. Lieber, M. Prato, R.V. Bellamkonda, G.A. Silva, N.W.S. Kam, F. Patolsky and L. Ballerini, "Nanomaterials for neural interfaces," *Adv. Mater.* **21**, 3970-4004 (2009).
319. X.P. Gao, G. Zheng and C.M. Lieber, "Subthreshold regime has the optimal sensitivity for nanowire FET biosensors," *Nano Lett.* **10**, 547-552 (2010).
320. Q. Qing, S.K. Pal, B. Tian, X. Duan, B.P. Timko, T. Cohen-Karni, V.N. Murthy and C.M. Lieber, "Nanowire transistor arrays for mapping neural circuits in acute brain slices," *Proc. Natl. Acad. Sci. USA* **107**, 1882-1887 (2010).
321. T. Cohen-Karni, Q. Qing, Q. Li, Y. Fang and C.M. Lieber, "Graphene and nanowire transistors for cellular interfaces and electrical recording," *Nano Lett.* **10**, 1098-1102 (2010).
322. B.P. Timko, T. Cohen-Karni, Q. Qing, B. Tian and C.M. Lieber, "Design and implementation of functional nanoelectronic interfaces with biomolecules, cells and tissue using nanowire device arrays," *IEEE Trans. Nanotechnol.* **9**, 269-280 (2010).
323. G. Zheng, X. Gao and C.M. Lieber, "Frequency domain detection of biomolecules using silicon nanowire biosensors," *Nano Lett.* **10**, 3179-3183 (2010).
324. B. Tian, T. Cohen-Karni, Q. Qing, X. Duan, P. Xie and C.M. Lieber, "Three-dimensional, flexible nanoscale field effect transistors as localized bioprobes," *Science* **329**, 831-834 (2010).
325. S. Kwon, J. Kang, C. Seassal, S. Kim, P. Regreny, Y. Lee, C.M. Lieber and H. Park, "Subwavelength plasmonic lasing from a semiconductor nanodisk with silver nanopan cavity," *Nano Lett.* **10**, 3679-3683 (2010).

326. X. Jiang, J. Hu, L.A. Fitzgerald, J.C. Biffinger, P. Xie, B. R. Ringeisen and C.M. Lieber, "Probing electron transfer mechanisms in *Shewanella oneidensis* MR-1 using a nanoelectrode platform and single cell imaging," *Proc. Natl. Acad. Sci. USA* **107**, 16806-16810 (2010).
327. G. Yu and C.M. Lieber, "Assembly and integration of semiconductor nanowires for functional nanosystems," *Pure Appl. Chem.* **82**, 2295-2314 (2010).
328. H. Yan, H.S. Choe, S.W. Nam, Y. Hu, S. Das, J.F. Klemic, J.C. Ellenbogen and C.M. Lieber, "Programmable nanowire circuits for nanoprocessors," *Nature* **470**, 240-244 (2011).
329. X. Jiang, B. Tian, J. Xiang, F. Qian, G. Zheng, H. Wang, L. Mai and C.M. Lieber, "Rational growth of branched nanowire heterostructures with synthetically encoded properties and function," *Proc. Natl. Acad. Sci. USA* **108**, 12212-12216 (2011).
330. B. Tian and C.M. Lieber, "Design, synthesis, and characterization of novel nanowire structures for photovoltaics and intracellular probes," *Pure Appl. Chem.* **83**, 2153-2169 (2011).
331. T. Cohen-Karni, B. Tian and C.M. Lieber, "Electrical recording from cardiac cells and tissue using nanowire transistors," *Nanomedicine and the Cardiovascular System* (eds. R.J. Hunter and V.R. Preedy), Science Publishers, 2011.
332. C.M. Lieber, "Semiconductor nanowires: A platform for nanoscience and nanotechnology," *MRS Bull.* **36**, 1052-1063 (2011).
333. G.F. Zheng and C.M. Lieber, "Nanowire biosensors for label-free, real-time, ultrasensitive protein detection," *Nanoproteomics Methods and Protocols* (eds. S.A. Toms and R.J. Wells), Humana Press, 2011.
334. Y. Hu, F. Kuemmeth, C.M. Lieber and C.M. Marcus, "Hole spin relaxation in Ge/Si core-shell nanowire qubits," *Nat. Nanotechnol.* **7**, 47-50 (2012).
335. T.J. Kempa, J.F. Cahoon, S.-K. Kim, R.W. Day, D.C. Bell, H.-G. Park and C.M. Lieber, "Coaxial multishell nanowires with high-quality electronic interfaces and tunable optical cavities for ultrathin photovoltaics," *Proc. Natl. Acad. Sci. USA* **109**, 1407-1412 (2012).
336. J.-U. Park, S. Nam, M.-S. Lee and C.M. Lieber, "Synthesis of monolithic graphene-graphite integrated electronics," *Nat. Mater.* **11**, 120-125 (2012).
337. P. Xie, Q. Xiong, Y. Fang, Q. Qing and C.M. Lieber, "Local electrical potential detection of DNA by nanowire-nanopore sensors," *Nat. Nanotechnol.* **7**, 119-125 (2012).
338. X. Duan, R. Gao, P. Xie, T. Cohen-Karni, Q. Qing, H.S. Choe, B. Tian, X. Jiang and C.M. Lieber, "Intracellular recordings of action potentials by an extracellular nanoscale field-effect transistor," *Nat. Nanotechnol.* **7**, 174-179 (2012).
339. Z. Jiang, Q. Qing, P. Xie, R. Gao and C.M. Lieber, "Kinked p-n junction nanowire probes for high spatial resolution sensing and intracellular recording," *Nano Lett.* **12**, 1711-1716 (2012).
340. T. Cohen-Karni, D. Casanova, J. Cahoon, Q. Qing, D. Bell and C.M. Lieber, "Synthetically-encoded ultrashort-channel nanowire transistors for fast, point-like cellular signal detection," *Nano Lett.* **12**, 2639-2644 (2012).
341. R. Gao, S. Strehle, B. Tian, T. Cohen-Karni, P. Xie, X. Duan, Q. Qing and C.M. Lieber, "Outside looking in: Nanotube transistor intracellular sensors," *Nano Lett.* **12**, 3329-3333 (2012).

342. S.K. Kim, R.W. Day, J. Cahoon, T. Kempa, K. Song, H.-G. Park and C.M. Lieber, "Tuning light absorption in core/shell silicon nanowire photovoltaic devices through morphological design," *Nano Lett.* **12**, 4971-4976 (2012).
343. B. Tian, J. Liu, T. Dvir, L. Jin, J.H. Tsui, Q. Qing, Z. Suo, R. Langer, D.S. Kohane and C.M. Lieber, "Macroporous nanowire nanoelectronic scaffolds for synthetic tissues," *Nat. Mater.* **11**, 986-994 (2012).
344. E.J.H. Lee, X. Jiang, R. Aguado, G. Katsaros, C.M. Lieber and S. De Franceschi, "Zero-bias anomaly in a nanowire quantum dot coupled to superconductors," *Phys. Rev. Lett.* **109**, 186802-1-5 (2012).
345. L. Xu, Z. Jiang, Q. Qing, L. Mai, Q. Zhang and C.M. Lieber, "Design and synthesis of diverse functional kinked nanowire structures for nanoelectronic bioprobes," *Nano Lett.* **13**, 746-751 (2013).
346. T. Kempa, R. Day, S. Kim, H. Park and C.M. Lieber, "Semiconductor nanowires: A platform for exploring limits and concepts for nano-enabled solar cells," *Energy Environ. Sci.* **6**, 719-733 (2013).
347. J. Liu, C. Xie, X. Dai, L. Jin, W. Zhou and C.M. Lieber, "Multifunctional three-dimensional macroporous nanoelectronic networks for smart materials," *Proc. Natl. Acad. Sci. USA.* **110**, 6694-6699 (2013).
348. T. Cohen-Karni and C.M. Lieber, "Nanowire nanoelectronics: Building interfaces with tissue and cells at the natural scale of biology," *Pure and Appl. Chem.* **85**, 883-901 (2013).
349. J. Yao, H. Yan and C.M. Lieber, "A nanoscale combing technique for the large-scale assembly of highly aligned nanowires," *Nat. Nanotechnol.* **8**, 329-335 (2013).
350. B. Tian and C.M. Lieber, "Synthetic nanoelectronic probes for biological cells and tissues," *Annu. Rev. Anal. Chem.* **6**, 31-51 (2013).
351. X. Duan, T.-M. Fu, J. Liu and C.M. Lieber, "Nanoelectronics-biology frontier: From nanoscopic probes for action potential recording in live cells to three-dimensional cyborg tissues," *Nano Today* **8**, 351-373 (2013).
352. X. Duan and C.M. Lieber, "Nanoelectronics meets biology: From new nanoscale devices for live-cell recording to 3D innervated tissues," *Chem. Asian J.* **8**, 2304-2314 (2013).
353. X. Jiang, J. Hu, E.R. Petersen, L.A. Fitzgerald, C.S. Jackan, A.M. Lieber, B.R. Ringeisen, C.M. Lieber and J.C. Biffinger, "Probing single- to multi-cell level charge transport in *Geobacter sulfurreducens* DL-1," *Nat. Commun.* **4**, 2751 (2013).
354. T. Kempa, S.-K. Kim, R. Day, H.-G. Park, D. Nocera and C.M. Lieber, "Facet-selective growth on nanowires yields multi-component nanostructures and photonic devices," *J. Am. Chem. Soc.* **135**, 18354-18357 (2013).
355. T. Kempa and C.M. Lieber, "Semiconductor nanowire solar cells: synthetic advances and tunable properties," *Pure Appl. Chem.* **86**, 13-26 (2014).
356. E. Lee, X. Jiang, M. Houzet, R. Aguado, C.M. Lieber, and S. De Franceschi, "Spin-resolved Andreev levels and parity crossings in hybrid superconductor-semiconductor nanostructures," *Nat. Nanotechnol.* **9**, 79-84 (2014).
357. Q. Qing, Z. Jiang, L. Xu, R. Gao, L. Mai and C.M. Lieber, "Free-standing kinked nanowire transistor probes for targeted intracellular recording in three dimensions," *Nat. Nanotechnol.* **9**, 142-147 (2014).
358. T.-M. Fu, X. Duan, Z. Jiang, X. Dai, P. Xie, Z. Cheng and C.M. Lieber, "Sub-10 nanometer intracellular bioelectronic probes from nanowire-nanotube heterostructures," *Proc. Natl. Acad. Sci. USA* **111**, 1259-1264 (2014).

359. J. Yao, H. Yan, S. Das, J. Klemic, J. Ellenbogen and C.M. Lieber, "Nanowire nanocomputer as a finite-state machine," *Proc. Natl. Acad. Sci. USA* **111**, 2431-2435 (2014).
360. W. Zhou, X. Dai, T.-M. Fu, C. Xie, J. Liu and C.M. Lieber, "Long term stability of nanowire nanoelectronics in physiological environments," *Nano Lett.* **14**, 1614-1619 (2014).
361. S.-K. Kim, K.-D. Song, T. Kempa, R. Day, C.M. Lieber and H.-G. Park, "Design of nanowire optical cavities as efficient photon absorbers," *ACS Nano* **8**, 3707-3714 (2014).
362. A. Higginbotham, T. Larsen, J. Yao, H. Yan, C.M. Lieber, C. Marcus and F. Kuemmeth, "Hole spin coherence in a Ge/Si heterostructure nanowire," *Nano Lett.* **14**, 3582-3586 (2014).
363. A. Higginbotham, F. Kuemmeth, T. Larsen, J. Yao, H. Yan, C.M. Lieber and C. Marcus, "Antilocalization of coulomb blockade in Ge/Si nanowire," *Phys. Rev. Lett.* **112**, 216806 (2014).
364. W. Shim, J. Yao and C.M. Lieber, "Programmable resistive-switch nanowire transistor logic circuits," *Nano Lett.* **14**, 5430-5436 (2014).
365. Q. Zhang, G. Li, X. Liu, F. Qian, Y. Li, T.C. Sum, C.M. Lieber and Q. Xiong, "A room temperature low-threshold ultraviolet plasmonic nanolaser," *Nat. Commun.* **5**, 5953 (2014).
366. X. Jiang, J. Hu, A. Lieber, C. Jackan, J. Biffinger, L. Fitzgerald, B. Ringeisen and C.M. Lieber, "Nanoparticle facilitated extracellular electron transfer in microbial fuel cells," *Nano Lett.* **14**, 6737-6742 (2014).
367. X. Duan and C.M. Lieber, "Nanoscience and the nano-bioelectronics frontier," *Nano Research* **8**, 1-22 (2015).
368. L. Chen, W. Lu and C.M. Lieber, "Semiconductor nanowire growth and integration," in *Semiconductor nanowires: From next-generation electronics to sustainable energy*, Ed. W. Lu and J. Xiang, Royal Society of Chemistry, 2015, 1-53.
369. N. Gao, W. Zhou, X. Jiang, G. Hong, T.-M. Fu and C.M. Lieber, "General strategy for biodetection in high ionic strength solutions using transistor-based nanoelectronic sensors," *Nano Lett.* **15**, 2143-2148 (2015).
370. R. Day, M. Mankin, R. Gao, Y.-S. No, S.-K. Kim, D. Bell, H.-G. Park and C.M. Lieber, "Plateau-Rayleigh crystal growth of periodic shells on one-dimensional substrates," *Nat. Nanotechnol.* **10**, 345-352 (2015).
371. P. Kruskal, Z. Jiang, T. Gao and C.M. Lieber, "Beyond the patch clamp: Nanotechnologies for intracellular recording," *Neuron* **86**, 21-24 (2015).
372. J. Liu, T.-M. Fu, Z. Cheng, G. Hong, T. Zhou, L. Jin, M. Duvvuri, Z. Jiang, P. Kruskal, C. Xie, Z. Suo, Y. Fang and C.M. Lieber, "Syringe-injectable electronics," *Nat. Nanotechnol.* **10**, 629-636 (2015).
373. M. Mankin, R. Day, R. Gao, Y.-S. No, S.-K. Kim, A. McClelland, D. Bell, H.-G. Park and C.M. Lieber, "Facet-selective epitaxy of compound semiconductors on faceted silicon nanowires," *Nano Lett.* **15**, 4776-4782 (2015).
374. G. Hong, T.-M. Fu, T. Zhou, T. Schuhmann, J. Huang and C.M. Lieber, "Syringe injectable electronics: Precise targeted delivery with quantitative input/output connectivity," *Nano Lett.* **15**, 6979-6984 (2015).
375. A.P. Alivisatos, H. Tierney, P. Weiss and C.M. Lieber, "ACS Nano and Nano Letters, partners in leading nanoscience and nanotechnology," *Nano Lett.* **15**, 4845-4845 (2015).

376. T.J. Kempa, D.K. Bediako, E.C. Jones, C.M. Lieber and D.G. Nocera, "Facile, rapid, and large-area periodic patterning of semiconductor substrates with submicron inorganic structures," *J. Am. Chem. Soc.* **137**, 3739-3742 (2015).
377. C. Xie, J. Liu, T.-M. Fu, X. Dai, W. Zhou and C.M. Lieber, "Three-dimensional macroporous nanoelectronic networks as minimally invasive brain probes," *Nat. Mater.* **14**, 1286-1292 (2015).
378. A. Zhang and C.M. Lieber, "Nano-bioelectronics," *Chem. Rev.* **116**, 215-257 (2016).
379. J.-H. Lee, A. Zhang, S. You and C.M. Lieber, "Spontaneous internalization of cell penetrating peptide-modified nanowires into primary neurons," *Nano Lett.* **16**, 1509-1513 (2016).
380. R. Day, M. Mankin and C.M. Lieber, "Plateau-Rayleigh crystal growth of nanowire heterostructures: Strain-modified surface chemistry and morphological control in one, two and three dimensions," *Nano Lett.* **16**, 2830-2836 (2016).
381. Y. Zhao, J. Yao, L. Xu, M. Mankin, Y. Zhu, H. Wu, L. Mai, Q. Zhang and C.M. Lieber, "Shape-controlled deterministic assembly of nanowires," *Nano Lett.* **16**, 2644-2650 (2016).
382. Y. Brovman, J. Small, Y. Hu, Y. Fang, C.M. Lieber and P. Kim, "Electric field effect thermoelectric transport in individual silicon and germanium/silicon nanowires," *J. Appl. Phys.* **119**, 234304 (2016).
383. Y.-S. No, R. Gao, M. Mankin, R. Day, H.-G. Park and C.M. Lieber, "Encoding active device elements at nanowire tips," *Nano Lett.* **16**, 4713-4719 (2016).
384. X. Dai, W. Zhou, T. Gao, J. Liu and C.M. Lieber, "Three-dimensional mapping and regulation of action potential propagation in nanoelectronics-innervated tissues," *Nat. Nanotechnol.* **11**, 776-782 (2016).
385. A. Zhang, G. Zheng and C.M. Lieber, *Nanowires: Building blocks for nanoscience and nanotechnology*, Springer 2016.
386. T.-M. Fu, G. Hong, T. Zhou, T. Schuhmann, R.D. Viveros and C.M. Lieber, "Stable long-term chronic brain mapping at the single neuron level," *Nat. Methods* **13**, 875-882 (2016).
387. N. Gao, T. Gao, X. Yang, X. Dai, W. Zhou, A. Zhang and C.M. Lieber, "Specific detection of biomolecules in physiological solutions using graphene transistor biosensors," *Proc. Natl. Acad. Sci. USA* **113**, 14633-14638 (2016).
388. W. Zhou, X. Dai and C.M. Lieber, "Advances in nanowire bioelectronics," *Rep. Prog. Phys.* **80**, 016701 (2017).
389. E.J.H. Lee, X. Jiang, R. Zitko, R. Aguado, C.M. Lieber and S. De Franceschi, "Scaling of sub-gap excitations in a superconductor-semiconductor nanowire quantum dot," *Phys. Rev. B* **95**, 180502(R) (2017).
390. T. Zhou, G. Hong, T.-M. Fu, X. Yang, T.G. Schuhmann, R.D. Viveros and C.M. Lieber, "Syringe-injectable mesh electronics integrate seamlessly with minimal chronic immune response in the brain," *Proc. Natl. Acad. Sci. USA* **114**, 5894-5899 (2017).
391. P.E. Sheehan and C.M. Lieber, "Friction between van der Waals solids during lattice directed sliding," *Nano Lett.* **17**, 4116-4121 (2017).
392. T. Ozel, B.A. Zhang, R. Gao, R.W. Day, C.M. Lieber and D.G. Nocera, "Electrochemical deposition of conformal and functional layers on high aspect ratio silicon micro/nanowires," *Nano Lett.* **17**, 4502-4507 (2017).

393. R. Wang, R.S. Deacon, J. Yao, C.M. Lieber and K. Ishibashi, "Electrical modulation of weak-antilocalization and spin orbit interaction in dual gated Ge/Si core/shell nanowires," *Semicond. Sci. Tech.* **32**, 094002 (11 pp) (2017).
394. T.G. Schuhmann, J. Yao, G. Hong, T.-M. Fu and C.M. Lieber, "Syringe-injectable electronics with a plug-and-play input/output interface," *Nano Lett.* **17**, 5836-5842 (2017).
395. T.-M. Fu, G. Hong, R.D. Viveros, T. Zhou and C.M. Lieber, "Highly scalable multichannel mesh electronics for stable chronic brain electrophysiology," *Proc. Natl. Acad. Sci. USA* **114**, E10046-E10055 (2017).
396. G. Hong, X. Yang, T. Zhou and C.M. Lieber, "Mesh electronics: a new paradigm for tissue-like brain probes," *Curr. Opin. Neurobiol.* **50**, 33-41 (2018).
397. X. Dai, G. Hong, T. Gao and C.M. Lieber, "Mesh nanoelectronics: seamless integration of electronics with tissues," *Acc. Chem. Res.* **51**, 309-318 (2018).
398. G. Hong, R.D. Viveros, T.J. Zwing, X. Yang and C.M. Lieber, "Tissue-like neural probes for understanding and modulating the brain," *Biochemistry* **57**, 3995-4004 (2018).
399. G. Hong, T.-M. Fu, M. Qian, R.D. Viveros, X. Yang, T. Zhou, J.M. Lee, H.-G. Park, J.R. Sanes and C.M. Lieber, "A method for single-neuron chronic recording from the retina in awake mice," *Science* **360**, 1447-1451 (2018).
400. T.G. Schuhmann, T. Zhou, G. Hong, J.M. Lee, T.-M. Fu, H.-G. Park and C.M. Lieber, "Syringe-injectable mesh electronics for stable chronic rodent electrophysiology," *J. Vis. Exp.* **137**, e58003 (2018).
401. J. Sun, R.S. Deacon, R. Wang, J. Yao, C.M. Lieber and K. Ishibashi, "Helical hole state in multiple conduction modes in Ge/Si core/shell nanowire," *Nano Lett.* **18**, 6144-6149 (2018).
402. R. Wang, R.S. Deacon, J. Sun, J. Yao, C.M. Lieber and K. Ishibashi, "Gate tunable hole charge qubit formed in a Ge/Si nanowire double quantum dot coupled to microwave photons," *Nano Lett.* **19**, 1052-1060 (2019).
403. X. Yang, T. Zhou, T.J. Zwing, G. Hong, Y. Zhao, R.D. Viveros, T.-M. Fu, T. Gao and C.M. Lieber, "Bioinspired neuron-like electronics," *Nat. Mater.* **18**, 510-517 (2019).
404. G. Hong and C.M. Lieber, "Novel electrode technologies for neural recordings," *Nat. Rev. Neurosci.* **20**, 330-345 (2019).
405. B. Tian and C.M. Lieber, "Nanowired bioelectric interfaces," *Chem. Rev.* **119**, 9136-9152 (2019).
406. R.D. Viveros, T. Zhou, G. Hong, T.-M. Fu, H.Y.G. Lin and C.M. Lieber, "Advanced one- and two-dimensional mesh designs for injectable electronics," *Nano Lett.* **19**, 4180-4187 (2019).
407. Y. Zhao, S. You, A. Zhang, J.-H. Lee, J.L. Huang and C.M. Lieber, "Scalable ultrasmall three-dimensional nanowire transistor probes for intracellular recording," *Nat. Nanotechnol.* **14**, 783-790 (2019).
408. J.M. Lee, G. Hong, D. Lin, T.G. Schuhmann, A.T. Sullivan, R.D. Viveros, H.-G. Park and C.M. Lieber, "Nano-enabled direct contact interfacing of syringe-injectable mesh electronics," *Nano Lett.* **19**, 5818-5826 (2019).
409. A. Zhang, Y. Zhao, S.S. You and C.M. Lieber, "Nanowire probes could drive high-resolution brain-machine interfaces," *Nano Today* **31**, 100821 (2019):
<https://www.sciencedirect.com/science/article/pii/S1748013219306929>

410. S.R. Patel and C.M. Lieber, "Precision electronic medicine in the brain," *Nat. Biotechnol.* **37**, 1007-1012 (2019).
411. N.M. Tran, K. Shekhar, I.E. Whitney, A. Jacobi, I. Benhar, G. Hong, W. Yan, X. Adiconis, M.E. Arnold, J.M. Lee, J.Z. Levin, D. Lin, C. Wang, C.M. Lieber, A. Regev, Z. He and J.R. Sanes, "Single-cell profiles of retinal ganglion cells differing in resilience to injury reveal neuroprotective genes," *Neuron* **86**, 21-24 (2019).
412. M. Sistani, J. Delaforce, R. B. G. Kramer, N. Roch, M. A. Luong, M.I. den Hertog, E. Robin, J. Smoliner, J. Yao, C.M. Lieber, C. Naud, A. Lugstein and O. Buisson, "Highly transparent contacts to the 1D hole gas in ultrascaled Ge/Si core/shell nanowires," *ACS Nano* **13**, 14145–14151 (2019).
413. J.M. Lee, D. Lin, H.-R. Kim, Y.W. Pyo, G. Hong, C.M. Lieber and H.-G. Park, "All-Tissue-like Multifunctional Optoelectronic Mesh for Deep-Brain Modulation and Mapping," *Nano Lett.* **21**, 3184-3190 (2021).
414. A. Zhang, J.-H. Lee and C.M. Lieber, "Nanowire-enabled bioelectronics", *Nano Today* **38**, 101135 (2021): <https://www.sciencedirect.com/science/article/pii/S1748013221000608?dgcid=author>
415. J.M. Lee, G. Hong, K.H. Kim, H.G. Park and C.M. Lieber, "Scalable three-dimensional recording electrodes for probing biological tissues," *Nano Lett.* **22**, 4552-4559 (2022).
416. J.M. Lee, D. Lin, Y.-W. Pyo, H.-R. Kim, H.-G. Park and C.M. Lieber, "Stitching flexible electronics into the brain," *Adv. Sci.*, **10**, 2300220 (2023). **News Highlight:** <https://www.advancedsciencenews.com/a-thread-like-neurological-probe-offers-unprecedented-insights-into-the-brain/>
417. D. Lin, J. M. Lee, C. Wang, H.-G. Park and C.M. Lieber, "Injectable ventral spinal stimulator evokes programmable and biomimetic hindlimb motion" *Nano Lett.* **23**, 6184-6192 (2023). <https://pubs.acs.org/doi/10.1021/acs.nanolett.3c01806>; also see: <https://www.biorxiv.org/content/10.1101/2023.06.15.545178v1> .
418. A. Zhang, E.T. Manderville, L. Xu, C.M. Stry, E.H. Lo and C.M. Lieber, "Ultra-flexible endovascular probes for brain recording through micron-scale vasculature", *Science* **381**, 306-312 (2023). *Accompanying Perspective:* B. Timko, "Neural implants without brain surgery", *Science* **381**, 268-269 (2023).
419. X. Yang, Y. Qi, C. Wang, T.J. Zwang, N.J. Rommelfanger, G. Hong and C.M. Lieber, "Laminin-coated electronic scaffolds with vascular topography for tracking and promoting the migration of brain cells after injury", *Nat. Biomed. Eng.*, **7**, 1282-1292 (2023). <https://doi.org/10.1038/s41551-023-01101-6>.
420. A. Zhang, T.J. Zwang and C.M. Lieber, "Biochemically-functionalized probes for cell type specific targeting and recording in the brain", *Sci. Adv.* **9**, eadk1050 (2023). <http://www.science.org/doi/10.1126/sciadv.adk1050> ; also see: <https://www.biorxiv.org/content/10.1101/2023.10.02.560579v1> .
421. C.P. Fucetola, J.T. Wang, O.A. Bolonduro, C.M. Lieber and B.P. Timko, "Single-crystal silicon nanotubes, hollow nanocones, and branched nanotube networks", *ACS Nano* **18**, 3775-3782 (2024). <https://doi.org/10.1021/acs.nano.3c11841?urlappend=%3Fref%3DPDF&jav=VoR&rel=cite-as>

Patents

Lieber's original work has resulted in more than 100 United States and International patents issued and pending. These breakthroughs have served as the underlying intellectual property for several small

companies, including Nanosys, Inc., Nantero and Vista Therapeutics. Issued and pending United States patents are as follows:

US Patents Issued

1. C.M. Lieber, Z.J. Zhang and C. Niu, "Covalent Carbon Nitride Material Comprising C₂N and Formation Method," US Patent **5,840,435** issued 24 November 1998.
2. C.M. Lieber and P. Yang, "Metal Oxide Nanorods," US Patent **5,897,945** issued 27 April 1999.
3. C.M. Lieber and E. Wong, "Preparation of Carbide Nanorods," US Patent **5,997,832** issued 7 December 1999.
4. C.M. Lieber and P. Yang, "Method of Producing Metal Oxide Nanorods," US Patent **6,036,774** issued 14 March 2000.
5. C.M. Lieber, S.S. Wong, A.T. Woolley and E. Joselevich, "Nanometer-Scale Microscopy Probes," US Patent **6,159,742** issued 12 December 2000.
6. C.M. Lieber and H. Dai, "Carbide Nanomaterials," US Patent **6,190,634** issued 20 February 2001.
7. J.H. Hafner, C.L. Cheung and C.M. Lieber, "Fabrication of Nanotube Microscopy Tips," US Patent **6,716,409** issued 6 April 2004.
8. C.M. Lieber, J.H. Hafner, C.L. Cheung and P. Kim, "Direct Growth of Nanotubes, and Their Use in Nanotweezers," US Patent **6,743,408** issued 1 June 2004.
9. C.M. Lieber, T. Rueckes, E. Joselevich and K. Kim, "Nanoscopic Wire-Based Devices and Arrays," US Patent **6,781,166** issued 24 August 2004.
10. A. DeHon, C.M. Lieber, P.D. Lincoln and J.E. Savage, "Stochastic Assembly of Sublithographic Nanoscale Interfaces," US Patent **63,900,479** issued 31 May 2005.
11. A. DeHon, C.M. Lieber, P.D. Lincoln and J.E. Savage, "Sublithographic Nanoscale Memory Architecture," US Patent **6,963,077** issued 8 November 2005.
12. A. DeHon and C.M. Lieber, "Array-Based Architecture for Molecular Electronics," US Patent **7,073,157** issued 4 July 2006.
13. C.M. Lieber, H. Park, Q. Wei, Y. Cui and W. Liang, "Nanosensors," US Patent **7,129,554** issued 31 October 2006.
14. C.M. Lieber, T. Rueckes, E. Joselevich and K. Kim, "Methods of Forming Nanoscopic Wire-Based Devices and Arrays," US Patent **7,172,953** issued 6 February 2007.
15. C.M. Lieber, Y. Cui, X. Duan and Y. Huang, "Doped Elongated Semiconductors, Growing Such Semiconductors, Devices Including Such Semiconductors and Fabricating Such Devices," US Patent **7,211,464** issued 1 May 2007.
16. C.M. Lieber, X. Duan, Y. Huang and R. Agarwal, "Nanoscale Coherent Optical Components," US Patent **7,254,151** issued 7 August 2007.
17. C.M. Lieber, H. Park, Q. Wei, Y. Cui and W. Liang, "Nanosensors," US Patent **7,256,466** issued 14 August 2007.

18. A. DeHon, M.J. Wilson and C.M. Lieber, "Nanoscale Wire-Based Sublithographic Programmable Logic Arrays," US Patent **7,274,208** issued 25 September 2007.
19. C.M. Lieber, X. Duan, Y. Cui, Y. Huang, M. Gudiksen, L.J. Lauhon, J. Wang, H. Park, Q. Wei, W. Liang, D.C. Smith, D. Wang and Z. Zhong, "Nanoscale Wires and Related Devices," US Patent **7,301,199** issued 27 November 2007.
20. C.M. Lieber, H. Park, Q. Wei, Y. Cui and W. Liang, "Nanosensors," US Patent **7,385,267** issued 10 June 2008.
21. C.M. Lieber, T. Rueckes, E. Joselevich and K. Kim, "Methods of Forming Nanoscopic Wire-Based Devices and Arrays," US Patent **7,399,691** issued 15 July 2008.
22. C.M. Lieber, Y. Cui, X. Duan and Y. Huang, "Doped Elongated Semiconductors, Growing Such Semiconductors, Devices Including Such Semiconductors and Fabricating Such Devices," US Patent **7,476,596** issued 13 January 2009.
23. DeHon and C.M. Lieber, "Array-Based Architecture for Molecular Electronics," US Patent **7,500,213** issued 3 March 2009.
24. C.M. Lieber, Y. Cui, X. Duan and Y. Huang, "Doped Elongated Semiconductors, Growing Such Semiconductors, Devices Including Such Semiconductors, and Fabricating Such Devices," US Patent **7,595,260** issued 29 September 2009.
25. C.M. Lieber, H. Park, Q. Wei, Y. Cui and W. Liang, "Nanosensors," US Patent **7,619,290** issued 17 November 2009.
26. C.M. Lieber, Y. Cui, X. Duan and Y. Huang, "Doped Elongated Semiconductors, Growing Such Semiconductors, Devices Including Such Semiconductors and Fabricating Such Devices," US Patent **7,666,708** issued 23 February 2010.
27. A. DeHon, C.M. Lieber, P.D. Lincoln and J.E. Savage, "Nanoscale Wire Coding for Stochastic Assembly," US Patent **7,692,952** issued 6 April 2010.
28. D.G. Grier, R. Agarwal, G. Yu, C.M. Lieber, K. Ladavac and Y. Roichman, "System and Method for Processing Nanowires with Holographic Optical Tweezers," US Patent **7,772,543** issued 10 August 2010.
29. W. Lu, J. Xiang, Y. Wu, B.P. Timko, H. Yan and C.M. Lieber, "Nanowire Heterostructures," US Patent **7,858,965** issued 28 December 2010.
30. C.M. Lieber, H. Park, Q. Wei, Y. Cui and W. Liang, "Nanosensors," US Patent **7,911,009** issued 22 March 2011.
31. C.M. Lieber, Y. Cui, X. Duan and Y. Huang, "Doped Elongated Semiconductors, Growing Such Semiconductors, Devices Including Such Semiconductors, and Fabricating Such Devices," US Patent **7,915,151** issued 28 March 2011.
32. H. Park, C.M. Lieber, J.J. Urban, Q. Gu and W.S. Yun, "Transition Metal Oxide Nanowires," US Patent **7,918,935** issued 5 April 2011.
33. C.M. Lieber, B. Tian and X. Jiang, "Branched Nanoscale Wires," US Patent **8,058,640** issued 15 November 2011.
34. A. DeHon, C.M. Lieber, J.E. Savage and E. Rachlin, "Apparatus, Method and Computer Program Product Providing Radial Addressing of Nanowires," US Patent **8,072,005** issued 6 December 2011.

35. C.M. Lieber, Y. Wu and H. Yan, "Nanoscale Wire-Based Data Storage," US Patent **8,154,002** issued 10 April 2012.
36. C. M. Lieber, Y. Cui, X. Duan and Y. Huang, "Doped Elongated Semiconductors, Growing Such Semiconductors, Devices Including Such Semiconductors, and Fabricating Such Devices," US Patent **8,153,470** issued 10 April 2012.
37. C.M. Lieber, T. Rueckes, E. Joselevich and K. Kim, "Nanoscopic Wire-Based Devices and Arrays," US Patent **8,178,907** issued 15 May 2012.
38. C.M. Lieber, F. Patolsky and G. Zheng, "Nanoscale Sensors," US Patent **8,232,584** issued 31 July 2012.
39. C.M. Lieber, X. Gao and G. Zheng, "High-Sensitivity Nanoscale Wire Sensors," US Patent **8,575,663** issued 5 November 2013.
40. C.M. Lieber, G. Yu and A. Cao, "Liquid Films Containing Nanostructured Materials," US Patent **8,586,131** issued 19 Nov 2013.
41. C.M. Lieber, Q. Xiong, P. Xie and Y. Fang, "High-Resolution Molecular Sensor," US Patent **8,698,481** issued 15 April 2014.
42. C.M. Lieber, S. Nam and J.-U. Park, "Controlled Synthesis of Monolithically-Integrated Graphene Multilayer Structures," US Patent **9,029,836** issued 12 May 2015.
43. C.M. Lieber, Y. Fang and F. Patolsky, "Nanosensors and Related Technologies," US Patent **9,102,521** issued 11 August 2015.
44. B. Tian, P. Xie, T.J. Kempa, C.M. Lieber, T. Cohen-Karni, Q. Qing and X. Duan, "Bent Nanowires and Related Probing of Species," US Patent **9,297,796 B2** issued 29 March 2016.
45. C.M. Lieber, T. Dvir, D.S. Kohane, R.S. Langer, J. Liu and B. Tian, "Scaffolds Comprising Nanoelectronic Components, Tissues, and Other Application," US Patent **9,457,128** issued 4 October 2016.
46. C.M. Lieber, X. Gao, G. Zheng, "High-Sensitivity Nanoscale Wire Sensors," US Patent **9,535,063** issued 3 January 2017.
47. C.M. Lieber, H.S. Choe and X. Liu, "Nanoscale Field-Effect Transistors for Biomolecular Sensors and Other Applications," US Patent **9,541,522** issued 10 January 2017.
48. C.M. Lieber, X. Duan, R. Gao, P. Xie and X. Jiang, "Nanoscale Wires, Nanoscale Wire FET Devices, and Nanotube-Electronic Hybrid Devices for Sensing and Other Applications," US Patent **9,595,685 B2** issued 14 March 2017.
49. C.M. Lieber, R. Gao, X. Duan, S. Strehle, T. Cohen-Karni, B. Tian, P. Xie and Q. Qing, "Nanoscale Sensors for Intracellular and Other Applications," US Patent **9,638,717 B2** issued 2 May 2017.
50. C.M. Lieber and P. Xie, "Nanopore Sensing by Local Electrical Potential Measurement," US Patent **9,702,849** issued 11 July 2017.
51. C.M. Lieber, B. Tian and J. Liu, "Methods and Systems for Scaffolds Comprising Nanoelectronic Components," US Patent **9,786,850** issued 10 October 2017.
52. C.M. Lieber, Y. Fang and F. Patolsky, "Nanosensors and Related Technologies," US Patent **9,903,862** issued 27 February 2018.

53. C.M. Lieber, S.-K. Kim, R. Day, H.-G. Park and T. Kempa, “Anisotropic Deposition in Nanoscale Wires,” US Patent **10,049,871** issued 14 August 2018.
54. C.M. Lieber, Q. Xiong, P. Xie and Y. Fang, “High-Resolution Molecular Sensor,” US Patent **10,119,955** issued 6 November 2018.
55. C.M. Lieber, B. Tian and J. Liu, “Methods and Systems for Scaffolds Comprising Nanoelectronic Components,” US Patent **10,355,229** issued 16 July 2019.
56. C.M. Lieber, J. Liu, B. Tian, T. Dvir, R.S. Langer and D.S. Kohane, “Scaffolds Comprising Nanoelectronic Components, Tissues, and Other Applications,” US Patent **10,369,255** issued 6 August 2019.
57. C.M. Lieber, R. Day, M. Mankin, R. Gao and T.J. Kempa, “Controlled Growth of Nanoscale Wires,” US Patent **10,435,817** issued 8 October 2019.
58. C.M. Lieber and P. Xie, “Nanopore Sensing by Local Electrical Potential Measurement,” US Patent **10,436,747** issued 8 October 2019.