BIOGRAPHICAL SKETCH

NAME	POSITION TITLE
Timothy Eric McKnight	Research Staff Oak Ridge National Laboratory Oak Ridge, Tennessee
eRA COMMONS USER NAME (credential, e.g., agency login) mcknightte	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
University of Michigan, Ann Arbor	B.S. Eng	5/89	Engineering Science
University of Tennessee, Knoxville	M.S. Eng	5/96	Engineering Science

A. Personal Statement

I employ material science and engineering to develop biomedical devices that incorporate nanostructured functionality for interfacing to tissue at the cellular and subcellular levels. My work has focused upon the application of a unique nanostructured material, the vertically aligned carbon nanofiber, which provides interfacing to tissue via multiple modalities including electrophysiologically (extracellular field potential measurement and stimulus), electroanalytically (via amperometric and voltammetric techniques), and genetically, whereby DNA and RNA modified nanostructured spikes may be integrated and assimilated intracellularly for gene expression and silencing within highly localized populations of cells. These latter techniques provide extremely rapid transgene expression, as the nanostructured spikes typically achieve nuclear residence, resulting in immediate transcriptional activity of the delivered DNA constructs. The combination of these modalities provides exciting new possibilities to manipulate and monitor biological processes at extremely high spatial resolutions within localized regions of tissue, or via microfluidic sampling systems which incorporate nanostructured materials as their active sensing elements.

B. Positions and Honors

Positions and Employment

1988 Intern, Molecular Toxicology Laboratories, Dow Chemical, Midland, MI
1989- Research Staff, Oak Ridge National Laboratory, Oak Ridge, TN

Other Experience and Professional Memberships

2003 Ad Hoc Member NASA Intramural Review Panel
2006 Ad Hoc Reviewer NIBIB Training Grant K25
2009 Ad Hoc Reviewer NIH Research Infrastructure Grand Opportunities
2010 Ad Hoc Reviewer NIH NCI Centers of Cancer Nanotechnology Excellence Review Study Section
2012-2015 Chairman Oak Ridge National Laboratory Seed Money Proposal Review Committee

Honors

1995 R&D 100 Award, Gravimetric Mass Flow Calibrator
2003 Federal Laboratory Consortium Southeast Region Project of the Year Award
2005 World's Best Technologies Showcase Finalist
2012 Invited National Academy of Engineering Frontiers of Engineering 2012 Symposium
2014 Battelle Memorial Institute Distinguished Inventor

C. Peer-reviewed Publications

1. Holcomb D.E., **McKnight T.E.**, *Transducers for Temperature, Pressure, and Flow*, Encyclopedia of Applied Physics, Volume 22 (1998).
2. Hardy J.E., Hylton J.O, **McKnight T.E**., Ruppel F.R., and Remenyik C.J., *Flow Measurement Methods and Applications,* John Wiley and Sons, December 1998.
3. Jacobson S.C., **McKnight T.E.**, Ramsey J.M., Microfluidic Devices for Electrokinetically Driven Parallel and Serial Mixing, Analytical Chemistry, 71,20, OCT 15,1999.
4. Gottschlich N, Culbertson CT, **McKnight TE**, Jacobson SC, Ramsey JM. Integrated microchip-device for the digestion, separation and postcolumn labeling of proteins and peptides. J Chromatogr B Biomed Sci Appl. 2000 Aug 4;745(1):243-9.
5. Khandurina J., **McKnight T.E.**, Jacobson S.C., Waters L.C., Foote R.S., J. Michael Ramsey. 2000. Integrated System for Rapid PCR-Based DNA Analysis in Microfluidic Devices. Anal Chem. 72: 2995-3000.
6. **McKnight T.E.**, Culbertson CT, Jacobson SC, and J. Michael Ramsey; Electroosmotically Induced Hydraulic Pumping with Integrated Electrodes on Microfluidic Devices, Analytical Chemistry; 2001; 73(16); 4045-4049.
7. Guillorn, M.A., **McKnight, T.E.**, Melechko, A.V., Austin D.W., Merkulov, V.I., Simpson, M.L.and Lowndes, D.H. Individually addressable vertically aligned carbon nanofiber-based electrochemical probes, J. Appl. Phys. 91, 3824, 2002.
8. Melechko AV, **McKnight TE**, Guillorn MA, Austin DW, Ilic B, Merkulov VI, Doktycz MJ, Lowndes DH, and Simpson ML. Nanopipe fabrication using vertically aligned carbon nanofiber templates. J. Vac. Sci. Tech. B. 20(6), Nov./Dec. 2002.
9. Simpson, M. L., T. E. McKnight, M. A. Guillorn, V. I. Merkulov, G. S. Sayler, and A. V. Melechko. "Integration of Cells into Microscale and Nanoscale Systems." Cellular Computing, Martyn Amos, Editor, Oxford University Press, 2004.
10. Melechko AV, **McKnight TE**, Guillorn MA, Merkulov VI, Ilic B, Doktycz MJ, Lowndes DH, Simpson ML. Vertically aligned carbon nanofibers as sacrificial templates for nanofluidic structures. Appl Phys Lett 82(6): 9760978, 2003.
11. **McKnight TE**, Melechko AV, Griffin GD, Guillorn MA, Merkulov VI, Serna F, Hensley DK, Doktycz MJ, Lowndes DH and Simpson ML. Intracellular integration of synthetic nanostructures with viable cells for controlled biochemical manipulation, Nanotechnology 14 (5), 551-556, 2003.
12. **McKnight TE**, Melechko AV, Guillorn MA, Merkulov VI, Doktycz MJ, Culbertson CT, Jacobson SC, Lowndes DH, Simpson ML. Effects of microfabrication processing on the electrochemistry of carbon nanofiber electrodes. J Phys Chem B 107 (39): 10722-10728, 2003
13. Melechko AV, **McKnight TE**, Hensley DK, Guillorn MA, Borisevich AY, Merkulov VI, Lowndes DH, Simpson ML. Large-scale synthesis of arrays of high-aspect-ratio rigid vertically aligned carbon nanofibres. Nanotechnology 14 (9): 1029-1035. 2003.
14. Ripp S, Daumer KA, **McKnight TE**, Levine LH, Garland JL, Simpson ML, Sayler GS. Bioluminescent bioreporter integrated-circuit sensing of microbial volatile organic compounds. J. Industrial Microbiology & Biotechnology 30 (11): 636-642. 2003.
15. Nivens DE, **McKnight TE**, Moser SA, Osbourn SJ, Simpson ML, Sayler GS. Bioluminescent bioreporter integrated circuits: potentially small, rugged and inexpensive whole-cell biosensors for remote environmental monitoring. J Appl Microbiology 96 (1): 33-46. 2004.
16. Love LJ, Jansen JF, **McKnight TE**, Roh Y, Phelps TJ. A magnetocaloric pump for microfluidic applications, IEEE Transactions on Nanobioscience 3 (2): 101-110. 2004.
17. Britton CL, Bryan WL, Wintenberg AL, Warmack RJ, **McKnight TE**, Frank SS, Cooper RG, Dudney NJ, Veith GM, Stephan AC. A detector for neutron imaging. IEEE TRANSACTIONS ON NUCLEAR SCIENCE 51 (3): 1016-1019 Part 3, JUN 2004.
18. **McKnight TE**, Melechko AV, Hensley DK, Griffin GD, Mann D, Simpson ML, Tracking Gene Expression after DNA Delivery Using Spatially Indexed Nanofiber Arrays, NanoLetters 4(7): 1213-1219. 2004.
19. **McKnight TE**, Melechko AV, Austin DW, Sims GT, Guillorn MA, Simpson ML, Microarrays of Vertically-Aligned Carbon Nanofiber Electrodes in an Open Fluidic Channel, J. Phys. Chem. B 108(22): 7115-7125. 2004.
20. Fletcher BL, Hullander ED, Melechko AV, **McKnight TE**, Klein KL, Hensley DK, Morrell JL, Simpson ML, Doktycz MJ, Microarrays of biomimetic cells formed by the controlled synthesis of carbon nanofiber membranes, NanoLetters 4 (10): 1809-1814 OCT 2004.
21. Love LJ, Jansen JF, **McKnight TE**, Roh Y, Phelps TJ, Yeary LW, Cunningham GT. Ferrofluid Field Induced Flow for Microfluidic Applications, IEEE Transactions on Mechatronics, 10(1):68-76, 2005.
22. Jun SI, Rack PR, **McKnight TE**, Simpson ML. A statistical parameter study of ITO (indium tin oxide) thin films deposited by RF sputtering. Thin Solid Films, 476(1): 59-64, 2005.
23. Jun SI, Rack PD, **McKnight TE**, et al. Electrical and microstructural characterization of molybdenum tungsten electrodes using a combinatorial thin film sputtering technique JOURNAL OF APPLIED PHYSICS 97 (5): Art. No. 054906 MAR 1 2005.

24. **McKnight TE**, Melechko AV, Griffin GD, Jun SI, Rack PD, Guillorn MA, Merkulov VI, Simpson ML. Optically and electrically addressed carbon nanofiber electrode arrays for intracellular interfacing, Proc of the SPIE, 5588: 128-135, 2004.
25. Hardy JE, **McKnight TE**, Reducing uncertainty in low flows for bench top wind tunnels, Sensor Review, Vol 25(1), 46-50, 2005.
26. Melechko AV, Merkulov VI, **McKnight TE**, Guillorn MA, Klein KL, Lowndes DH, Simpson ML. Vertically aligned carbon nanofibers and related structures: Controlled synthesis and directed assembly. J OF APPLIED PHYSICS 97 (4): Art. No. 041301, 2005.
27. Jun S.-I., **McKnight TE**, Melechko AV, Simpson ML, Rack PD. Characterization of reactively sputtered silicon oxide for thin-film transistor fabrication, Electronics Letters, Volume 41, Issue 14, 07:59–60, 2005.
28. Jun SI, Rack PD, **McKnight TE**, et al. Direct-current substrate bias effects on amorphous silicon sputter-deposited films for thin film transistor fabrication APPLIED PHYSICS LETTERS 87 (13): Art. No. 132108 SEP 26 2005
29. **McKnight TE**, Melechko AV, Griffin GD, Guillorn MA, Simpson ML. Synthetic nanoscale elements for delivery of materials into viable cells. Methods Mol Biol 303: 191-208, 2005.
30. Klein KL, Melechko AV, Fowlkes JD, Rack PA, Hensley DK, Meyer HM, Allard LF, **McKnight TE**, Simpson ML. Formation of ultrasharp vertically aligned Cu-Si nanocones by a DC plasma process, J PHYS CHEM B 110 (10): 4766-4771, 2006.
31. Fletcher BL, **McKnight TE**, Melechko AV, Simpson ML, Doktycz MJ. Biochemical functionalization of vertically aligned carbon nanofibers. Nanotechnology 17 (2006) 2032.
32. Fletcher BL, **McKnight TE**, Melechko AV, Hensley DK, Thomas DK, Ericson MN, Simpson ML. Transfer of Flexible Arrays of Vertically Aligned Carbon Nanofiber Electrodes to Temperature Sensitive Substrates. Adv Mat 18: 2006, 18, 1689–1694, 2006.
33. **McKnight TE**, Peeraphatdit C, Jones SW, Melechko AV, Klein K, Fowlkes J, Fletcher BL, Doktycz MJ, Simpson ML. Site Specific Biochemical Functionalization Along the Height of Vertically-Aligned Carbon Nanofiber Arrays. Chemistry of Materials: 18(14); 3203-3211, 2006.
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37. Mann DGJ, **McKnight TE**, Melechko AV, Simpson ML, Sayler GS. Quantitative analysis of EDC-condensed DNA on vertically aligned carbon nanofiber arrays. Biotechnology and Bioengineering, Vol. 97(4):680-688. 2007.
38. **McKnight TE**, Melechko AV, Griffin GD, Simpson ML. Plant tissue transformation using periodic arrays of vertically aligned carbon nanofibers. IN VITRO CELLULAR & DEVELOPMENTAL BIOLOGY-ANIMAL 42: 17A-17A Suppl. S SPR 2006.
39. Yu Z, **McKnight TE**, Ericson MN, Melechko AV, Simpson ML, Morrison B, Vertically aligned carbon nanofiber array: A new type of microelectrode array for electrophysiological recording. J Neurotrauma 24 (7): 1235-1235 P22 JUL 2007.
40. Fletcher BL, **McKnight TE**, Fowlkes JD, Allison DP, Simpson ML, Doktycz MJ. Controlling the dimensions of carbon nanofiber structures through the electropolymerization of pyrrole. Synthetic Metals 157 282–289, 2007.
41. Yu Z, **McKnight TE**, Ericson MN, Melechko AV, Simpson ML, Morrison B. Vertically aligned carbon nanofiber arrays record electrophysiological signals from hippocampal slices. Nanoletters, 7 (8): 2188, 2007.
42. Melechko AV, Klein KL, Fowlkes JD, Hensley DK, Merkulov IA, **McKnight TE**, Rack PD, Horton JA, Simpson ML. Control of carbon nanostructures: From nanofiber toward nanotube and back. J of App Physics 102, 1, 2007.
43. **McKnight T E**; Ericson, M. N.; Jones, S. W.; Melechko, A. V.; Simpson, M. L.; Vertically Aligned Carbon Nanofiber Arrays: An Electrical and Genetic Substrate for Tissue Scaffolding. Engineering in Medicine and Biology Society, 2007. EMBS 2007. 29th Annual International Conference of the IEEE 22-26 Aug. 2007 Page(s):5381 – 5383
44. Fletcher BJ, Retterer ST, **McKnight TE**, Melechko AV, Fowlkes JD, Simpson ML, Doktycz MJ. Actuatable membranes based on polypyrrole-coated vertically aligned carbon nanofibers. ACS Nano 2(2): 247-254. 2008.
45. Mann, D. G. J., **McKnight TE**, McPherson JT, Hoyt PR, Melechko AV, Simpson ML, Sayler GS. Inducible RNA Interference-Mediated Gene Silencing Using Nanostructured Gene Delivery Arrays. ACS Nano 2(1): 69-76, 2008.
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48. Peckys DB, De Jonge N, Simpson ML, **McKnight TE**. End-specific attachment strategies for long double stranded DNA onto gold-coated nanofiber arrays. Nanotechnology 19 (2008) 435301.
49. Park JW, Kwon SY, Jun SI, **McKnight TE**, Melechko AV, Simpson ML, Dhindsa M, Heikenfeld J, Rack PD. Active-matrix microelectrode arrays integrated with vertically aligned carbon nanofibers. IEEE Electron Device Letters 30(3): 254-257, 2009.
50. Peckys DB, Melechko AV, Simpson ML, **McKnight TE**. Immobilization and release strategies for DNA delivery using carbon nanofiber arrays and self-assembled monolayers, Nanotechnology 20:14, 2009.
51. Fletcher, B. L., J. T. Fern, **McKnight TE**, et al. (2009). "Effects of ultramicroelectrode dimensions on the electropolymerization of polypyrrole." Journal of Applied Physics 105(12).
52. Kalyanaraman, M., S. T. Retterer, **McKnight TE** et al. (2009). Controlled microfluidic production of alginate beads for in situ encapsulation of microbes. 2009 First Annual Ornl Biomedical Science & Engineering Conference: Exploring the Intersections of Interdisciplinary Biomedical Research. New York, IEEE: 100-103.
53. Melechko, A. V., R. Desikan, **McKnight TE** et al. (2009). "Synthesis of vertically aligned carbon nanofibres for interfacing with live systems." Journal of Physics D-Applied Physics 42(19).
54. Lamprecht, M.R., **T.E. McKnight**, M.N. Ericson, and B. Morrison (2010), VACNF arrays for recording dopamine concentrations in the brain, in 2010 IEEE 36th Annual Northeast Bioengineering Conference.
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60. Railsback JG, Singh A, Pearce RC, **McKnight TE**, Collazo R, Sitar Z, Yingling YG, Melechko AV (2012) Weakly charged cationic nanoparticles induce DNA bending and strand separation. Adv. Mater 24: 4261-4265.
61. Pearce RC, Railsback JG, Anderson BD, Sarac MF, **McKnight TE**, Tracy JB, Melechko AV (2013) Transfer of vertically aligned carbon nanofibers to polydimethylsiloxane (PDMS) while maintaining their alignment and impalefection functionality. ACS App Mat & Interfaces 5:878-882.
62. Kodumagulla A, Varanasi V, Pearce RC, Wu WC, Hensley DK, Tracy JB, **McKnight TE**, Melechko AV (2014) Aerosynthesis: growth of vertically-aligned carbon nanofibres with air DC plasma. Nanomaterials and Nanotechnology 4:6 doi: 10.5772/58449.
63. Pearce R, **McKnight TE**, Klein KL, Ivanov IN, Hensley D, Meyer Harry III, Melechko AV (2014) Synthesis and properties of SiN coatings as stable fluorescent markers on vertically aligned carbon nanofibers. AIMS Materials Science DOI:10.3934/matersci.2014.1.87

Patents issued (in chronological order); 18 additional pending

6,060,315 Method for Facilitating the Introduction of Material into Cells
6,533,733 Implantable Device for In Vivo Intracranial and Cerebrospinal Fluid Pressure Monitoring
6,982,519 Individually electrically addressable vertically aligned carbon nanofibers on insulating substrates
7,144,287 Individually electrically addressable carbon nanofibers on insulating substrates
7,229,692 Nanoconduits and nanoreplicants
7,621,878 Implant for In-Vivo Parameter Monitoring, Processing and Transmitting
7,641,863 Nanoengineered membranes for controlled transport
7,943,196 Nanotransfer and nanoreplication using deterministically grown sacrificial nanotemplates
8,003,220 Nanotransfer and nanoreplication using deterministically grown sacrificial nanotemplates
8,076,124 Method and apparatus for sustaining viability of biological cells on a substrate
8,101,388 Method and structure for extracting molecular species
8,142,877 Nano transfer and nanoreplication using deterministically grown sacrificial nanotemplates
8,343,766 Method and apparatus for sustaining viability of biological cells on a substrate

8,657,883 Remote actuated valve implant
8,815,780 Platform for immobilization and observation of subcellular processes
8,993,327 Parallel macromolecular delivery and biochemical/electrochemical interface to cells employing nanostructures

Provisional 14/212,718 Rapid and Highly Fieldable Viral Diagnostic

D. Research Support

Ongoing Research Support

My effort for the last 3 years has been predominantly focused on Work for Others efforts (with proprietary content) as well as the Oak Ridge National Laboratory's Laboratory Research and Development Program, for which I serve as the Chair of the Seed Money Proposal Review Committee. This is a rotational period and will be completed in February of 2015.

ORNL Technology Innovation Program McKnight (PI) 10/2014-9/2015
Phase II Rapid Viral Diagnostics
The goal of this project is to further develop, towards commercialization, a rapid and highly fieldable assay for dengue virus and to leverage advances for diagnostics of other high priority pathogens including Ebola, PRRSv, and PEDv.

Completed Research Support

ORNL Lab Directed R&D McKnight (PI) 01/01/13-09/30/13
Rapid and Highly Fieldable Viral Diagnostics
The goal of this project was to perform proof of principle for a highly fieldable transgene-based assay for the detection of DenV infection. In-vitro studies demonstrated the potential to measure the activity of DenV NS5 RdRp within cultured cells within 6 hrs of viral challenge.
Role: PI

DTRA McKnight (PI) 2011
Angioperf
The goal of this short term project was to evaluate the potential of arrays of vertically aligned carbon nanofibers to perforate the blood-brain barrier to temporarily provide enhanced transport across this exclusionary boundary. Techniques to translate our unique material into an endoscopic tool were successfully developed.
Role: PI

ORNL Lab Directed R&D McKnight (PI) 2009-2011
Remote Microfluidic Platform using Smart Materials and Structures
The goal of this project was to develop a fetoscopically-implantable valve that may be deployed into the fetal trachea as an intervention for the congenital birth defect, diaphragmatic hernia, whereby abdominal organs invade pulmonary space via the compromised diaphragm. This valve provides a means to clinically actuate a tracheal occlusion to enable transient inflation of the fetal lung so as to displace the abdominal organs and allow proper pulmonary development. A remote actuated valve was developed using thermally reactive polymers and an RF excitation system, and initial studies were conducted in fetal sheep.
Role: PI

ORNL Lab Directed R&D McKnight (PI) 2008-2009
Cell-Borne Chip for Controlled Therapeutic Protein Production
The goal of this project was to develop a mechanical delivery system for transgene production of therapeutic proteins in circulating cells.

NIH NIBIB EB006316 McKnight (PI) 2005-2007
Nanoscale Architectures for Controlled Gene Expression
The goal of this R01 was the development of subcellular probes for dynamic manipulation of transgene expression within interfaced cells; essentially a hybrid nano/genetic scaffold serving as artificial chromatin for delivery and modulation of exogenous genes.

NIH NIBIB EB000433 McKnight (PI) 2002-2004
Nano Arrays for Real-Time Probing within Living Cells
The goal of this R01 was the development of subcellular probes for electrophysiological and electroanalytical probing of cells and tissue matrices.