Aaron D. Franklin

Curriculum Vita

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Education

Ph.D. Electrical Engineering	**Purdue University** West Lafayette, IN	2008
B.S. Electrical Engineering Minor: Communication	**Arizona State University** Tempe, AZ	2004
General Studies	**Mesa Community College** Mesa, AZ	2002

Academic and Professional Appointments

Duke University

- *Associate Dean for Faculty Affairs* (Pratt School of Engineering) 2023 – Present
- *Addy Professor* (Departments of Electrical & Computer Engineering (ECE) and Chemistry) 2020 – Present
- *Associate Dean for Doctoral Education* (Pratt School of Engineering) 2021 – 2023
- *Director of Graduate Studies* (Department of ECE) 2017 – 2021
- *James L. and Elizabeth M. Vincent Associate Professor* (Departments of ECE and Chemistry) 2018 – 2020
- *Associate Professor* (Departments of ECE and Chemistry) 2014 – 2018

AddiLathe

- *Co-founder & Scientific Director* 2024 – Present

Versametrics LLC

- *Co-founder & Scientific Director* 2020 – Present

Tyrata, Inc. – *acquired by Bridgestone in 2023*

- *Co-founder & Chief Technology Officer (CTO)* 2017 – 2023

Columbia University

- *Adjunct Assistant Professor* (Department of Electrical Engineering) 2013 – 2014

IBM T. J. Watson Research Center

- *Research Staff Member* (Physical Science and Silicon departments) 2008 – 2014

Ivy Tech Community College

- *Adjunct Faculty* (Department of Mathematics) 2007 – 2008

Purdue University

- *NSF Graduate Research Fellow* (School of Electrical and Computer Engineering) 2005 – 2008

Honors and Awards

- NAI (National Academy of Inventors) Fellow 2025
- IEEE Fellow (*for contributions to transistor scaling and carbon nanotubes applications in electronics*) 2024
- MCC Hall of Fame for Alumni Achievement 2022
- Dean's Award for Excellence in Mentoring 2021
- Capers & Marion McDonald Award for Excellence in Teaching and Research 2020
- Best Poster Award (*advisor*) at Device Research Conference (DRC) 2020
- Bass Chair & Fellow of Bass Society at Duke 2018
- Best Poster Award (*advisor*) at MRS Fall Meeting 2018
- Best Paper Award (*advisor*) at international IEEE Sensors conference 2017
- 2nd Place at MRS iMatSci Innovation Showcase for Tire Tread Wear Sensor Technology 2017
- Best Poster Award (*advisor*) at Device Research Conference (DRC) 2017
- IBM Labyrinth Award for Invention Accomplishments 2014
- IBM Outstanding Technical Achievement Award 2014
- IBM Research Outstanding Contributor Award 2013
- GOMAC Technology Conference #1 Outstanding Paper Award 2012
- IBM Invention Achievement Awards 2009, 2011, 2012, 2013
- GOMAC Technology Conference Meritorious Paper Award 2010

- National Science Foundation (NSF) Graduate Research Fellowship (GRF) 2005 – 2008
- First place poster prize and NSF travel scholarship for Nano and Giga Conference 2007
- Materials Research Society (MRS) Graduate Student Silver Award 2006
- NASA Institute for Nanoelectronics and Computing (INaC) Fellowship 2005 – 2006
- Purdue University Andrews Recruiting Fellowship 2005 – 2006
- Graduate of Barrett Honors College at Arizona State University 2004
- Arizona State University Distinguished Electrical Engineering Senior of the Year Award 2004
- Fifteen top-ranking awards in persuasive, informative, and impromptu speaking and debate at various Intercollegiate Speech and Debate tournaments 2001 – 2002

Academic Leadership

Associate Dean for Faculty Affairs: *Duke, Pratt School of Engineering* July 2023 – present

- Lead all faculty affairs initiatives, including appointments, promotions, and tenure (APT), faculty leaves, flexible work arrangements, and sabbatical requests
- Support annual review of faculty via scholarly activity reports, including facilitating the implementation of faculty affairs software for more streamlined reviews with data analytics
- Manage all regular-rank faculty searches and recruiting including efforts to recruit and retain a faculty that upholds the values of diversity and inclusivity
- Develop and administer mentoring programs for faculty, especially junior and mid-career faculty
- Administer processes, guidelines, and policies that ensure equitable workloads and compensation for faculty

Associate Dean for Doctoral Education: *Duke, Pratt School of Engineering* July 2021 – June 2023

- Managed PhD programs across Pratt School of Engineering (>600 PhD students), including finances
- Supported departmental directors of graduate studies
- Identified and implemented best practices to increase diversity, equity, and inclusion through proactive recruitment, retention, and outreach activities
- Enhanced PhD student experience and support through opportunities, including:
  - PhD Plus Professional Development Program: Orchestrated program overhaul, with new app-tracking integration (using *Suitable*) and multiyear career prep cycle that includes connection to industry. Resulted in 3x increase in student engagement and transformative development opportunities for students (e.g., https://pratt.duke.edu/about/news/revamped-phd-plus).
  - Muser Undergraduate Research Project Integration: Formalized Pratt's connection to Duke-wide research project opportunity database, developed mentorship training course, and facilitated 4x increase in PhD students mentoring undergraduate students in research
- Drafted dean's letters for appointment, promotion, and tenure cases

Director of Graduate Studies: *Duke, Department of Electrical & Computer Engineering* Sept. 2017 – June 2021

- Revised milestone exams, including qualifying and preliminary exams with student & faculty feedback
- Updated graduate program financial system to improve transparency and support target initiatives, including management through COVID-19 pandemic
- Managed program of ~200 PhD students, including resolving student challenges with research, advisor, health, etc.
- Supervised and led recruitment efforts for PhD and masters programs domestically and internationally
- Worked with PhD students through challenges of all types (e.g., advisor relationships, mental health, COVID-19 pandemic)

Publications (h-index = 47) | graduate students and undergraduate students from Franklin group

1. **A. D. Franklin**, "Creating high-performance transistors by coating carbon nanotube arrays," *Nature Electronics*, vol. 7, pp. 1068-1069, 2024.

2. J. L. Doherty, Y. Zhang, B. N. Smith, H. A. Hobbie, I. Kymissis, and **A. D. Franklin**, "Liquid crystal displays with printed carbon-based recyclable transistor backplanes," *IEEE Electron Device Lett.*, vol. 45, pp. 2427-2430, 2024.

3. H. A. Hobbie, J. L. Doherty, B. N. Smith, P. Maccarini, and **A. D. Franklin**, "Conformal printed electronics on flexible substrates and inflatable catheters using lathe-based aerosol jet printing," *npj Flexible Electronics*, vol. 8, pp. 54, 2024.

4. B. Zhang, H. A. Hobbie, Y. Wu, W. Bai, and **A. D. Franklin**, "MXene-contacted carbon nanotube thin-film transistors using aerosol jet printing," *IEEE Trans. Mater. Electron Devices (TMAT)*, vol. 1, pp. 90-96, 2024.

5. V. Pecunia, ... , F. M. Albarghouthi, B. N. Smith, **A. D. Franklin** et al., "Roadmap on printable electronic materials for next-generation sensors," *Nano Futures*, vol. 8, pp. 032001, 2024.

6. F. M. Albarghouthi, D. Semeniak, I. Khanani, J. L. Doherty, B. N. Smith, M. Salfity, Q. MacFarlane, S. G. Noyce, N. X. Williams, D. Y. Joh, J. B. Andrews, A. Chilkoti, and **A. D. Franklin**, "Addressing signal drift and screening for detection of biomarkers with carbon nanotube-based bioFETs," *ACS Nano*, vol. 18, pp. 5698-5711, 2024.

7. F. Mastrocinque, G. Bullard, J. A. Alatis, J. A. Albro, A. Nayak, N. X. Williams, A. Kumbhar, H. Meikle, Z. X. W. Widel, Y. Bai, A. Harvey, J. M. Atkin, D. H. Waldeck, **A. D. Franklin**, and M. J. Therien, "Band gap opening of metallic single-walled carbon nanotubes via noncovalent symmetry breaking," *PNAS*, vol. 121, pp. e2317078121, 2024.

8. B. N. Smith, P. Ballentine, J. L. Doherty, R. Wence, H. A. Hobbie, N. X. Williams, and **A. D. Franklin**, "Aerosol jet printing conductive 3D microstructures from graphene without post-processing," *Small*, vol. 20, pp. 2305170, 2024.

9. B. L. Huegen, J. L. Doherty, B. N. Smith, and **A. D. Franklin**, "Role of electrode configuration and morphology in printed prothrombin time sensors," *Sensors and Actuators B: Chemical*, vol. 399, pp. 134785, 2024.

10. J. Rich, B. Cole, T. Li, B. Lu, H. Fu, B. Smith, J. Xia, S. Yang, R. Zhong, J. L. Doherty, K. Kaneko, H. Suzuki, Z. Tian, **A. D. Franklin**, and T. J. Huang, "Aerosol jet printing surface acoustic wave microfluidic devices," *Microsystems & Nanoengineering*, vol. 10, pp. 2, 2024.

11. Z. Cheng, J. Backman, H. Zhang, H. Abuzaid, G. Li, Y. Yu, L. Cao, A. V. Davydov, M. Luisier, C. A. Richter, and **A. D. Franklin**, "Distinct contact scaling effects in MoS_2 transistors revealed with asymmetrical contact measurements," *Advanced Materials*, vol. 35, pp. 2210916, 2023.

12. S. Lu, B. N. Smith, H. Meikle, M. J. Therien, and **A. D. Franklin**, "All-carbon thin-film transistors using water-only printing," *Nano Lett.*, vol. 23, pp. 2100-2106, 2023.

13. E. G. Franklin, B. N. Smith, and **A. D. Franklin**, "Impact of NaCl concentration in crystalline nanocellulose for printed ionic dielectrics," *J. Emerging Investigators*, vol. 6, pp. 1-5, 2023.

14. C. McDonnell, F. Albarghouthi, R. Selhorst, N. Kelley-Loughnane, **A. D. Franklin**, and R. Rao, "Aerosol jet printed surface-enhanced Raman substrates: Application for high-sensitivity detection of perfluoroalkyl substances," *ACS Omega*, vol. 8, pp. 1597-1605, 2023.

15. **A. D. Franklin**, M. S. Hersam, and H.-S. P. Wong, "Carbon nanotube transistors: Making electronics from molecules," *Science*, vol. 378, pp. 726-732, 2022.

16. B. N. Smith, H. Meikle, J. L. Doherty, S. Lu, G. Tutoni, M. L. Becker, M. J. Therien, and **A. D. Franklin**, "Ionic dielectrics for fully printed carbon nanotube transistors: Impact of composition and induced stresses," *Nanoscale*, vol. 14, pp. 16845-16856, 2022.

17. F. Albarghouthi, N. X. Williams, J. L. Doherty, S. Lu, and **A. D. Franklin**, "Passivation strategies for enhancing the solution-gated carbon nanotube field-effect transistor biosensing performance and stability in ionic solutions," *ACS Applied Nano Materials*, vol. 5, pp. 15865-15874, 2022.

18. Z. Cheng, C. -S. Pang, P. Wang, S. T. Le, Y. Wu, D. Shahrjerdi, I. Radu, M. C. Lemme, L. -M. Peng, X. Duan, Z. Chen, J. Appenzeller, S. J. Koester, E. Pop, **A. D. Franklin**, and C. A. Richter, "How to report and benchmark emerging field-effect transistors," *Nature Electronics*, vol. 5, pp. 416-423, 2022.

19. Z. Cheng, H. Zhang, S. Le, H. Abuzaid, G. Li, L. Cao, A. Davydov, **A. D. Franklin**, and C. Richter, "Are two-dimensional interfaces really flat?" *ACS Nano*, vol. 16, pp. 5316-5324, 2022.

20. S. Ye, N. X. Williams, and **A. D. Franklin**, "Aerosol jet printing of SU-8 as a passivation layer against ionic solutions," *J. Electronic Mater.*, vol. 51, pp. 1583-1590, 2022.

21. S. Das, A. Sebastian, E. Pop, C. J. McClellan, **A. D. Franklin**, T. Grasser, T. Knobloch, A. V. Penumatcha, J. Appenzeller, Z. Chen, W. Zhu, I. Asselberghs, L. -J. Li, U. E. Avci, N. Bhat, T. D. Anthopoulos, and R. Singh, "Transistors based on two-dimensional materials for future integrated circuits," *Nature Electronics*, vol. 4, pp. 786-799, 2021.

22. H. Abuzaid, Z. Cheng, G. Li, L. Cao, and **A. D. Franklin**, "Unanticipated polarity shift in edge-contacted tungsten-based 2D transition metal dichalcogenide transistors," *IEEE Electron Device Letters*, vol. 42, pp. 1563-1566, 2021.

23. N. X. Williams, G. Bullard, N. Brooke, M. J. Therien, and **A. D. Franklin**, "Printable and recyclable carbon electronics using crystalline nanocellulose dielectrics," *Nature Electronics*, vol. 4, pp. 261-268, 2021.

24. Y. -C. Lin, G. B. Rayner, J. Cardenas, and **A. D. Franklin**, "Short-channel robustness from negative capacitance in 2D NC-FETs," *Appl. Phys. Lett.*, vol. 118, pp. 101903, 2021.

25. J. A. Cardenas, S. Lu, N. X. Williams, J. Doherty, and **A. D. Franklin**, "In-place printing of flexible electrolyte-gated carbon nanotube transistors with enhanced stability," *IEEE Electron Device Letters*, vol. 42, pp. 367-370, 2021. ***Listed among *Editor's Choice Articles***

26. C. Shen, S. Lu, Z. Tian, S. Yang, J. A. Cardenas, J. Li, X. Peng, T. J. Huang, **A. D. Franklin**, and S. A. Cummer, "Electrically tunable surface acoustic wave propagation at MHz frequencies based on carbon nanotube thin-film transistors," *Advanced Functional Materials*, vol. 31, pp. 2010744, 2021.

27. H. Abuzaid, N. X. Williams, and **A. D. Franklin**, "How good are 2D transistors? An application-specific benchmarking study," *Appl. Phys. Lett.*, vol. 118, pp. 030501, 2021. ***Listed among *APL's Featured Articles***

28. N. X. Williams, B. Carroll, S. G. Noyce, H. A. Hobbie, D. Y. Joh, J. G. Rogers, and **A. D. Franklin**, "Fully printed prothrombin time sensor for point-of-care testing," *Biosensors and Bioelectronics*, vol. 172, pp. 112770, 2021.

29. S. Lu and **A. D. Franklin**, "Printed carbon nanotube thin-film transistors: Progress on printable materials and the path to applications," *Nanoscale*, vol. 12, pp. 23371-23390, 2020.

30. S. Lu, J. Zheng, J. Cardenas, N. Williams, Y. -C. Lin, and **A. D. Franklin**, "Uniform and stable aerosol jet printing of carbon nanotube thin-film transistors by ink temperature control," *ACS Appl. Mater. Interfaces*, vol. 12, pp. 43083-43089, 2020.

31. S. G. Noyce, J. L. Doherty, S. Zauscher, and **A. D. Franklin**, "Understanding and mapping sensitivity in MoS_2 FET-based sensors," *ACS Nano*, vol. 14, pp. 11637-11647, 2020.

32. J. L. Doherty, S. G. Noyce, Z. Cheng, H. Abuzaid, and **A. D. Franklin**, "Capping layers to improve the electrical stress stability of MoS_2 transistors," *ACS Appl. Mater. Interfaces*, vol. 12, pp. 35698-35706, 2020.

33. J. A. Cardenas, H. Tsang, H. Tong, H. Abuzaid, K. Price, M. A. Cruz, B. J. Wiley, **A. D. Franklin**, and N. Lazarus, "Flash ablation metallization of conductive thermoplastics," *Additive Manufacturing*, vol. 36, pp. 101409, 2020.

34. N. X. Williams and **A. D. Franklin**, "Electronic tattoos: A promising approach to real-time theragnostics," *J. Dermatology and Skin Science*, vol. 2, pp. 5-16, 2020.

35. J. Cardenas, J. Andrews, S. Noyce, and **A. D. Franklin**, "Carbon nanotube electronics for IoT sensors," *Nano Futures*, vol. 4, pp. 012001, 2020.

36. N. X. Williams, N. Watson, D. Joh, A. Chilkoti, and **A. D. Franklin**, "Aerosol jet printing of biological inks by ultrasonic delivery," *Biofabrication*, vol. 12, pp. 025004, 2020.

37. S. Lu, J. A. Cardenas, R. Worsley, N. X. Williams, J. B. Andrews, C. Casiraghi, and **A. D. Franklin**, "Flexible, print-in-place 1D-2D thin-film transistors using aerosol jet printing," *ACS Nano*, vol. 13, pp. 11263-11272, 2019. ***Listed among *ACS Nano's Most Read Articles***

38. N. X. Williams, S. Noyce, J. A. Cardenas, M. Catenacci, B. J. Wiley, and **A. D. Franklin**, "Silver nanowire inks for direct-write electronic tattoo applications," *Nanoscale*, vol. 11, pp. 14294-14302, 2019. ***Listed among *Nanoscale's Most Popular Articles in 2019***

39. Z. Cheng, Y. Yu, S. Singh, K. Price, S. G. Noyce, Y. -C. Lin, L. Cao, and **A. D. Franklin**, "Immunity to scaling in MoS_2 transistors using edge contacts," *Nano Lett.*, vol. 19, pp. 5077-5085, 2019.

40. K. Price, S. Najmaei, C. Ekuma, R. Burke, M. Dubey, and **A. D. Franklin**, "Plasma-enhanced atomic layer deposition of HfO_2 on monolayer, bilayer, and trilayer MoS_2 for the integration of high-k dielectrics in 2D devices," *ACS Appl. Nano Mater.*, vol. 2, pp. 4085-4094, 2019.

41. Y. -C. Lin, F. McGuire, S. Noyce, N. Williams, Z. Cheng, J. Andrews, and **A. D. Franklin**, "Effects of gate stack composition and thickness in 2D negative capacitance FETs," *IEEE J. Electron Devices Society*, vol. 7, pp. 645-649, 2019.

42. J. B. Andrews, P. Ballentine, J. A. Cardenas, C. -J. Lim, N. X. Williams, J. Summers, M. Stangler, D. Koester, S. A. Cummer, and **A. D. Franklin**, "Printed electronic sensor array for mapping tire tread thickness profiles," *IEEE Sensors J.*, vol. 19, pp. 8913-8919, 2019.

43. Z. Cheng, H. Abuzaid, Y. Yu, F. Zhang, Y. Li, S. Noyce, N. Williams, Y. -C. Lin, J. Doherty, C. Tao, L. Cao, and **A. D. Franklin**, "Convergent ion beam alteration of 2D materials and metal-2D interfaces," *2D Mater.*, vol. 6, pp. 034005, 2019.

44. S. G. Noyce, J. L. Doherty, Z. Cheng, H. Han, S. Bowen, and **A. D. Franklin**, "Electronic stability of carbon nanotube transistors under long-term bias stress," *Nano Lett.*, vol. 19, pp. 1460-1466, 2019.

45. J. A. Cardenas, S. Upshaw, N. X. Williams, M. J. Catenacci, B. J. Wiley, and **A. D. Franklin**, "Impact of morphology on printed contact performance in carbon nanotube thin-film transistors," *Adv. Funct. Mater.*, vol. 29, pp. 1805727, 2019.

46. Z. Cheng, K. Price, and **A. D. Franklin**, "Contacting and gating two-dimensional nanomaterials," *IEEE Trans. Electron Devices*, vol. 65, pp. 4073-4083, 2018.

47. J. B. Andrews, J. A. Cardenas, C. J. Lim, S. G. Noyce, J. Mullett, and **A. D. Franklin**, "Fully printed and flexible carbon nanotube transistors for pressure sensing in automobile tires," *IEEE Sensors Journal*, vol. 18, pp. 7875-7880, 2018.

48. J. B. Andrews, K. Mondal, T. Neumann, J. A. Cardenas, J. Wang, D. P. Parekh, Y. Lin, P. Ballentine, M. D. Dickey, and **A. D. Franklin**, "Patterned liquid metal contacts for printed carbon nanotube transistors," *ACS Nano*, vol. 12, pp. 5482-5488, 2018.

49. J. A. Cardenas, M. J. Catennaci, J. B. Andrews, N. X. Williams, B. J. Wiley, and **A. D. Franklin**, "In-place printing of carbon nanotube transistors at low temperature," *ACS Appl. Nano Mater.*, vol. 1, pp. 1863-1869, 2018.

50. S. Najmaei, M. R. Neupane, B. M. Nichols, R. A. Burke, A. L. Mazzoni, M. L. Chin, D. A. Rhodes, L. Balicas, **A. D. Franklin**, and M. Dubey, "Cross-plane carrier transport in van der Waals layered materials," *Small*, vol. 14, pp. 1703808, 2018.

51. **A. D. Franklin**, D. Jena, and D. Akinwande, "75 years of the Device Research Conference – A history worth repeating," *IEEE J. Electron Devices Society*, vol. 6, pp. 116-120, 2018.

52. Y. -C. Lin, F. A. McGuire, and **A. D. Franklin**, "Realizing ferroelectric $Hf_{0.5}Zr_{0.5}O_2$ with elemental capping layers," *J. Vac. Sci. Technol. B*, vol. 36, pp. 011204, 2018. ***Listed among *JVST-B's Most Most Read & Cited Articles in 2018***

53. Q. Han, Y. Bai, J. Liu, K. Du, T. Li, D. Ji, Y. Zhou, C. Cao, D. Shin, J. Ding, **A. D. Franklin**, J. T. Glass, J. Hu, M. J. Therien, J. Liu, and D. B. Mitzi, "Additive engineering for high-performance room-temperature-processed perovskite absorbers with micron-size grains and microsecond-range carrier lifetimes," *Energy & Environmental Sci.*, vol. 10, pp. 2365-2371, 2017.

54. F. A. McGuire, Y. -C. Lin, K. Price, G. B. Rayner, S. Khandelwal, S. Salahuddin, and **A. D. Franklin**, "Sustained sub-60 mV/decade switching via the negative capacitance effect in MoS_2 transistors," *Nano Lett.*, vol. 17, pp. 4801-4806, 2017.

55. K. M. Price, K. E. Schauble, F. A. McGuire, D. B. Farmer, and **A. D. Franklin**, "Uniform growth of sub-5 nm high-κ dielectrics on MoS_2 using plasma-enhanced atomic layer deposition," *ACS Appl. Mater. Interfaces*, vol. 9, pp. 23072-23080, 2017.

56. J. B. Andrews, C. Cao, M. Brooke, and **A. D. Franklin**, "Noninvasive material thickness detection by aerosol jet printed sensors enhanced through metallic carbon nanotube ink," *IEEE Sensors Journal*, vol. 17, pp. 4612-4618, 2017.

57. C. Cao, J. B. Andrews, and **A. D. Franklin**, "Completely printed, flexible, stable, and hysteresis-free carbon nanotube thin-film transistors," *Adv. Electronic Mater.*, vol. 3, pp. 1700057, 2017.

58. M. J. Catenacci, P. F. Flowers, C. Cao, J. B. Andrews, **A. D. Franklin**, and B. J. Wiley, "Fully printed memristors from Cu-SiO_2 core-shell nanowire composites," *J. Electronic Mater.*, 2017.

59. N. D. Cox, C. D. Cress, J. E. Rossi, I. Puchades, A. Merrill, **A. D. Franklin**, and B. J. Landi, "Modification of silver/single-wall carbon nanotube electrical contact interfaces via ion irradiation," *ACS Appl. Mater. Interfaces*, vol. 9, pp. 7406-7411, 2017.

60. D. Joh, F. McGuire, R. Abedini-Nassab, J. Andrews, R. Achar, Z. Zimmers, D. Mozhdehi, R. Blair, F. Albarghouthi, W. Oles, J. Richter, C. Fontes, A. Hucknall, B. Yellen, **A. D. Franklin**, and A. Chilkoti, "Poly(oligo(ethylene glycol) methyl ether methacrylate) brushes on high-κ metal oxide dielectric surfaces for bioelectrical environments," *ACS Appl. Mater. Interfaces*, vol. 9, pp. 5522-5529, 2017.

61. S. Najmaei, S. Lei, R. Burke, B. M. Nichols, A. George, P. M. Ajayan, **A. D. Franklin**, J. Lou, and M. Dubey, "Enabling ultra-sensitive photo-detection through control of interface properties in molybdenum disulfide atomic layers," *Sci. Rep.*, vol. 6, pp. 39465, 2016.

62. F. A. McGuire, Z. Cheng, K. Price, and **A. D. Franklin**, "Sub-60 mV/decade switching in 2D negative capacitance field-effect transistors with integrated ferroelectric polymer," *Appl. Phys. Lett.*, vol. 109, pp. 093101, 2016.

63. Z. Cheng, J. A. Cardenas, F. A. McGuire, S. Najmaei, and **A. D. Franklin**, "Modifying the Ni-MoS_2 contact interface using a broad-beam ion source," *IEEE Electron Device Lett.*, vol. 37, pp. 1234-1237, 2016.

64. C. Cao, J. B. Andrews, A. Kumar, and **A. D. Franklin**, "Improving contact interfaces in fully printed carbon nanotube thin-film transistors," *ACS Nano*, vol. 10, pp. 5221-5229, 2016.

65. **A. D. Franklin**, "Nanomaterials in transistors—from high-performance to thin-film applications," *Science*, vol. 349, pp. aab2750, 2015.

66. J. Li, **A. D. Franklin**, and J. Liu, "Gate-free electrical breakdown of metallic pathways in single-walled carbon nanotube crossbar networks," *Nano Lett.*, vol. 15, pp. 6058-6065, 2015.

67. Q. Cao, S. -J. Han, J. Tersoff, **A. D. Franklin**, Y. Zhu, Z. Zhang, G. S. Tulevski, J. Tang, and W. Haensch, "End-bonded contacts for carbon nanotube transistors with low, size-independent resistance," *Science*, vol. 350, pp. 68-72, 2015.

68. C. -S. Lee, E. Pop, **A. D. Franklin**, W. Haensch, and H. -S. P. Wong, "A compact virtual-source model for carbon nanotube field-effect transistors in the sub-10-nm regime—Part II: Extrinsic elements, performance assessment, and design optimization," *IEEE Trans. Electron Devices*, vol. 62, pp. 3070-3078, 2015.

69. C. -S. Lee, E. Pop, **A. D. Franklin**, W. Haensch, and H. -S. P. Wong, "A compact virtual-source model for carbon nanotube field-effect transistors in the sub-10-nm regime—Part I: Intrinsic elements," *IEEE Trans. Electron Devices*, vol. 62, pp. 3061-3069, 2015.

70. G. S. Tulevski, **A. D. Franklin**, D. Frank, J. M. Lobez, Q. Cao, H. Park, A. Afzali, S. -J. Han, J. B. Hannon, and W. Haensch, "Toward high-performance digital logic technology with carbon nanotubes," *ACS Nano*, vol. 8, pp. 8730-8745, 2014.

71. **A. D. Franklin**, D. B. Farmer, and W. Haensch, "Defining and overcoming the contact resistance challenge in scaled carbon nanotube transistors," *ACS Nano*, vol. 8, pp. 7333-7339, 2014.

72. B. Kim, **A. D. Franklin**, C. Nuckolls, W. Haensch, and G. S. Tulevski, "Achieving low-voltage thin-film transistors using carbon nanotubes," *Appl. Phys. Lett.*, vol. 105, pp. 063111, 2014.

73. D. Shahrjerdi, **A. D. Franklin**, S. Oida, J. A. Ott, G. S. Tulevski, and W. Haensch, "High-performance air-stable n-type carbon nanotube transistors with erbium contacts," *ACS Nano*, vol. 7, pp. 8303-8308, 2013.

74. **A. D. Franklin**, "The road to carbon nanotube transistors," *Nature*, vol. 498, pp. 443-444, 2013.

75. **A. D. Franklin**, S. O. Koswatta, D. B. Farmer, J. T. Smith, L. Gignac, C. M. Breslin, S. -J. Han, G. S. Tulevski, H. Miyazoe, W. Haensch, and J. Tersoff, "Carbon nanotube complementary wrap-gate transistors," *Nano Lett.*, vol. 13, pp. 2490-2495, 2013.

76. J. Luo, L. Wei, C. -S. Lee, **A. D. Franklin**, X. Guan, E. Pop, D. A. Antoniadis, and H. -S. P. Wong, "A compact model for carbon nanotube field-effect transistors including non-idealities and calibrated with experimental data down to 9 nm gate length," *IEEE Trans. Electron Devices*, vol. 60, pp. 1834-1843, 2013.

77. J. T. Smith, **A. D. Franklin**, D. B. Farmer, and C. Dimitrakopoulos, "Reducing contact resistance in graphene devices through contact area patterning," *ACS Nano*, vol. 7, pp. 3661-3667, 2013.

78. G. S. Tulevski, **A. D. Franklin**, and A. Afzali-Ardakani, "High purity isolation and quantification of semiconducting carbon nanotubes via column chromatography," *ACS Nano*, vol. 7, pp. 2971-2976, 2013.

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61. J. T. Smith, **A. D. Franklin**, C. D. Dimitrakopoulos, "Transport conduits for contacts to graphene," U.S. Patent 8637850, ISSUED January 28, 2014.

62. **A. D. Franklin**, S. O. Koswatta, J. T. Smith, "Gate-all-around carbon nanotube transistor with selectively-doped spacers," U.S. Patent 8609481 B1, ISSUED December 17, 2013.

63. **A. D. Franklin**, J. B. Hannon, G. Tulevski, Z. Chen, "Local bottom gates for graphene and carbon nanotube devices," U.S. Patent 8587065 B2, ISSUED November 19, 2013.

64. **A. D. Franklin**, S. -J. Han, Z. Chen, "Vertical stacking of carbon nanotube arrays for current enhancement and control," U.S. Patent 8288759 B2, ISSUED October 16, 2012.

65. **A. D. Franklin**, J. B. Hannon, G. Tulevski, Z. Chen, "Local bottom gates for graphene and carbon nanotube devices," U.S. Patent 8124463 B2, ISSUED February 28, 2012.

During PhD at Purdue:

66. **A. D. Franklin**, M. R. Maschmann, T. S. Fisher, T. D. Sands, "Contact metallization of carbon nanotubes," U.S. Patent 9487877 B2, ISSUED November 8, 2016.

67. J. C. Claussen, **A. D. Franklin**, T. S. Fisher, D. M. Porterfield, "Electrochemical biosensor," U.S. Patent 8715981 B2, ISSUED May 6, 2014.

68. **A. D. Franklin**, T. D. Sands, T. S. Fisher, D. B. Janes, "Field effect transistor fabrication from carbon nanotubes," U.S. Patent 8872154, ISSUED October 28, 2014.

Invited Talks

Keynotes & Tutorials:

1. Nanotube 2024, "All-carbon nanomaterial inks for print-in-place, recyclable, and water-based electronics," MIT, Cambridge, MA, June 2024.

2. Nanotube 2023, "Nanoelectronics from nanomaterials: How we enable and hinder a promising future," Symposium on structure, properties, and applications, Arcachon, France, June 2023.

3. Device Research Conference (DRC) Short Course, "Contacts to 2D semiconductors for technology-relevant transistors: A tutorial and review of latest progress," Short Course on Two-dimensional Materials for the Semiconductor Industry, UCSB, Santa Barbara, CA, June 2023.

4. 2022 UB-IEEE Nano Symposium, "Nanomaterials versus the silicon "Goliath" for future transistors – How's the battle going and do we stand a chance?" University of Buffalo, Buffalo, NY, Sep. 2022.

5. BYU Management Society, "Behind the scenes of scientific research: Underlying ethics in what scientists study, discover, and communicate," webinar, Sep. 2022.

6. TMS 2022 Annual Meeting, "Going where silicon cannot reach: Print-in-place and recyclable electronics from nanomaterials," Anaheim, CA, Mar. 2022.

7. Innovations in Large Area Electronics (InnoLAE) Conference, "Print-in-place and recyclable electronics from nanomaterials," Cambridge, England (held virtually), Feb. 2022.

8. TechConnect World Innovation Conference & Expo, "Nanoscale carbon for print-in-place and recyclable electronics," Washington, DC, Oct. 2021.

9. Global Summit and Expo on Graphene and 2D Materials (2DMAT2021), "Print-in-place and recyclable electronics using mixed-dimensional nanomaterials," Paris, France, Aug. 2021.

10. IEEE International Conference on Flexible and Printable Sensors and Systems (IEEE FLEPS), "Aerosol jet printing with nanomaterial-based inks: A path towards recyclable, print-in-place electronics," Manchester, UK, June 2021.

11. BYU Management Society, "Behind the scenes of scientific research," webinar, Nov. 2020.

12. 2020 IEEE Nanotechnology Materials and Devices Conference (NMDC), "Print-in-place electronics using mixed-dimensional nanomaterials," virtual conference, Oct. 2020.

13. International Workshop on Nano/Micro 2D-3D Fabrication, Manufacturing of Electronic-Biomedical Devices & Applications (IWNEBD), "Ultrasensitive Carbon Nanotubes and Low-Cost Printing for Point-of-Care Biomedical Diagnostics," IIT-Mandi, Mandi, India, Nov. 2018.

14. Duke University Alumni Event, "Translating discoveries into successful companies," ITC Gardenia, Bangalore, India, Oct. 2018.

15. Duke University Alumni Event, "Translating discoveries into successful companies," ITC Maurya, New Delhi, India, Oct. 2018.

16. Sixteenth IEEE Workshop on Microelectronics and Electron Devices (WMED), "Nanomaterials for a new era of electronic devices: Extending and transforming the trend," Boise, ID, Apr. 2018.

17. BYU Management Society – Phoenix-East Chapter, "The hidden truth behind our explosive technological revolution," Arizona State University, Tempe, AZ, Mar. 2016.

18. 41st Micro and Nano Engineering (MNE) conference, "Promises, problems, and practicalities of nanomaterial electronics," The Hague, Netherlands, Sept. 2015.

Conferences:

1. Materials Research Society (MRS) Fall Meeting, "Observations on transport in contacts to 2D semiconductors using diverse contact structures," Boston, MA, Dec. 2024.
2. Materials Research Society (MRS) Fall Meeting, "Printing, recycling, and scaling transistors with nanomaterial inks," Boston, MA, Dec. 2024.
3. ECS PRiME 2024, "Tackling leakage, drift, and variation in printed carbon nanotube-based electronic biosensors," Honolulu, HI, Oct. 2024.
4. IEEE Nano 2024, "Tackling leakage, drift, and variation in printed carbon nanotube-based electronic biosensors," Gijon, Spain, June 2024.
5. Electrochemical Society (ECS) Meeting, "From Invention to Acquisition: Evolution of an Electronic Sensor Startup Catalyzed by Nanotubes," San Francisco, CA, May 2024.
6. Electrochemical Society (ECS) Meeting, "Tackling leakage, drift, and variation in printed carbon nanotube-based electronic biosensors," San Francisco, CA, May 2024.
7. TMS 2024 Annual Meeting, "All-carbon nanomaterial inks for print-in-place, recyclable, and water-based electronics," Orlando, FL, Mar. 2024.
8. Materials Research Society (MRS) Fall Meeting, "All-carbon nanomaterial inks for print-in-place, recyclable, and water-based electronics," Boston, MA, Nov. 2023.
9. IEEE International Conference on Flexible and Printable Sensors and Systems (FLEPS), "All-carbon nanomaterial inks for print-in-place, recyclable, and water-based electronics," Boston, MA, July 2023.
10. Device Research Conference (DRC), "Carbon-based nanomaterial inks for print-in-place, recyclable, and water-based electronics," UCSB, Santa Barbara, CA, June 2023.
11. Device Research Conference (DRC) Rump Session, "What makes a good device paper and how do you measure its impact?" UCSB, Santa Barbara, CA, June 2023.
12. Electrochemical Society (ECS) Meeting, "Tackling leakage, drift, and variation in printed carbon nanotube-based electronic biosensors," Boston, MA, May 2023.
13. TMS 2023 Annual Meeting, "All-carbon nanomaterial inks for print-in-place, recyclable, and water-based electronics," San Diego, CA, Mar. 2023.
14. IEEE NTC Forum on Nanotechnology for Soft Electronics, "Print-in-place and recyclable electronics from nanomaterials," NC State, Raleigh, NC, Dec. 2022.
15. Materials Research Society (MRS) Fall Meeting, "All-carbon nanomaterial inks for print-in-place, recyclable, and water-based electronics," Boston, MA, Nov. 2022.
16. Materials Research Society (MRS) Fall Meeting, "Being intentional about the industry-to-academia transition and other thoughts on preparing for an academic career," Boston, MA, Nov. 2022.
17. Society of Engineering Science (SES) Annual Meeting, "Print-in-place and recyclable electronics from nanomaterials," College Station, TX, Oct. 2022.
18. China Semiconductor Technology International Conference (CSTIC) at Semicon China, "Going where silicon cannot reach: Print-in-place and recyclable electronics from nanomaterials," virtual conference, Jul. 2022.
19. Electrochemical Society (ECS) Meeting, "Influence of materials and processing on edge contacts to 2D semiconductors," Vancouver, British Columbia, Canada, May 2022.
20. Triangle Electrochemical Society (TrECS), "Low-dimensional nanomaterials for electronics applications," Durham, NC, Feb. 2022.
21. Materials Research Society (MRS) Fall Meeting, "Going where silicon cannot reach: Print-in-place and recyclable electronics from low-dimensional nanomaterials," Boston, MA, Nov. 2021.
22. Electrochemical Society (ECS) Meeting, "From the top or through the edge: What is the most scalable contact to 2D semiconductors?" virtual conference, May 2021.

23. 5th IEEE Electron Devices Technology and Manufacturing (EDTM) Conference 2021, “From the top or through the edge: What is the most scalable contact to 2D semiconductors?” Chengdu, China – virtual conference, Mar. 2021.

24. 6th International Conference on Nanoscience and Nanotechnology (ICONN 2021), “Print-in-place electronics using mixed-dimensional nanomaterials,” Chennai, India – virtual conference, Feb. 2021.

25. Materials Research Society (MRS) Spring/Fall Combined Meeting, “Progress towards reproducible, robust, and recyclable printed electronics,” virtual conference, Dec. 2020.

26. Materials Research Society (MRS) Spring/Fall Combined Meeting, “Print-in-place electronics using mixed-dimensional nanomaterials,” virtual conference, Dec. 2020.

27. Materials Research Society (MRS) Spring/Fall Combined Meeting, “From the top or through the edge: What is the most scalable contact to 2D semiconductors?,” virtual conference, Dec. 2020.

28. Pacific Rim Meeting on Electrochemical and Solid State Science (PRiME 2020), “From the top or through the edge: What is the most scalable contact to 2D semiconductors?” virtual conference, Oct. 2020.

29. Electrochemical Society (ECS) Meeting, “Improving conducting and insulating interfaces to 2D materials,” Atlanta, GA, Oct. 2019.

30. China Semiconductor Technology International Conference (CSTIC) at Semicon China, "Scaling and printing electronics using nanomaterials," Shanghai, China, Mar. 2019.

31. Materials Research Society (MRS) Fall Meeting, “Harnessing the versatility of carbon nanotubes for printed electronics,” Boston, MA, Nov. 2018.

32. International Mechanical Engineering Congress & Exposition (IMECE), “Harnessing the Versatility of Carbon Nanotubes as Printed Thin Films,” Pittsburgh, PA, Nov. 2018.

33. 62nd International Conference on Electron, Ion, and Photon Beam Technology and Nanofabrication (EIPBN), “Scaling, stacking, and printing: How nanomaterials still hold promise for electronics,” Rio Grande, Puerto Rico, May 2018.

34. Electrochemical Society (ECS) Meeting, “Improving conducting and insulating interfaces to 2D materials,” Seattle, WA, May 2018.

35. Materials Research Society (MRS) Spring Meeting, “Harnessing the versatility of carbon nanotubes for printed electronics,” Phoenix, AZ, Apr. 2018.

36. XXVI International Materials Research Congress 2017, “Printing of biologicals and nanomaterials for point-of-care assays,” Cancun, Mexico, Aug. 2017.

37. 2017 Symposium on VLSI Technology, “Scaling, stacking, and printing: How 1D and 2D nanomaterials still hold promise for a new era of electronics,” Kyoto, Japan, June 2017.

38. International Symposium on Devices and Applications of Two-Dimensional Materials, “Stacking, damaging, and etching: Optimizing performance in 2D electronic devices,” Fudan University, Shanghai, China, July 2016.

39. Emerging Technologies CMOS 2016 Conference, “Promises and challenges of nanomaterial in transistors: From high-performance to thin-film applications,” Montreal, Quebec, Canada, May 2016.

40. TechConnect World 2016 – Nanotech, Microtech, Biotech, Cleantech, “Promises, problems, and practicalities of nanomaterials in transistors,” National Harbor, MD, May 2016.

41. MRS-ASM-AVS Joint Symposium, “Nanomaterials in Electronics,” NC State, Raleigh, NC, Nov. 2015.

42. Government Microcircuit Applications & Critical Technology Conference (GOMAC Tech), “Nanomaterials in the next-switch?” St. Louis, MO, Mar. 2015.

43. American Chemical Society (ACS) Meeting, “How will carbon nanotubes impact the next generation of electronics?” Denver, CO, Mar. 2015.

44. Gordon Research Conference—Nanostructure Fabrication, “Prospects for bottom-up 1D and 2D nanoelectronics in high-performance computing,” Biddeford, ME, Jul. 2014.

45. TechConnect World 2014 – Nanotech, Microtech, Biotech, Cleantech, “Prospects and challenges for carbon nanotube transistors in high performance nanoelectronics beyond 2020,” National Harbor, MD, June 2014.

46. Device Research Conference (DRC) – Rump Session, "What are 2D devices and materials good for?" Santa Barbara, CA, Jun. 2014.

47. International Semiconductor Device Research Symposium (ISDRS), "Latest developments toward a carbon nanotube transistor technology," Bethesda, MD, Dec. 2013.

48. International Conference on Solid State Devices and Materials (SSDM), "Wrapping carbon nanotubes in a gate-all-around geometry," Fukuoka, Japan, Sept. 2013.

49. Symposium on Recent Advances in Carbon-Based Nanoelectronics, "Scaling carbon nanotube transistors for a sub-10 nm digital technology," Peking University, Beijing, China, Jul. 2013.

50. Materials Research Society (MRS) Spring Meeting, "Nanoscale contacts to carbon nanomaterials," San Francisco, CA, Apr. 2013.

51. Gordon Research Conference – Nanostructure Fabrication, "Carbon Nanotubes for a New Generation of Transistors," University of New England, Biddeford, ME, Jul. 2012.

52. NYS Meeting of the American Physical Society, "Carbon nanotubes: Can they really replace silicon?" University of Albany, NY, Apr. 2011.

53. Lester Eastman Conference on High Performance Devices, "Interfacing with carbon nanomaterials—difficulties in accessing the intrinsic properties," Rensselaer Polytechnic Institute, NY, Aug. 2010.

Workshops:

1. Nano Futures Webinar, "Printable transistor-based biosensors from carbon nanotubes," virtual with panel, Oct. 2024.

2. FUSENANO – Molecules to Systems: The Future of Semiconductors with 1D & 2D Nanomaterials, "Future of Semiconductors (i.e., transistor technology) with 1D and 2D Materials," University of Arizona, Tucson, AZ, Feb. 2024.

3. MEC/DARPA Back-End-Of-Line (BEOL) Integration of Active Devices Workshop, "Nanomaterial synthesis and transfer methods for BEOL integration," Institute for Defense Analyses (IDA), Arlington, VA, May 2023.

4. Emotional Intelligence Leadership for Scientists & Engineers, "Role of Emotional Intelligence (EQ) As a Professor & Mentor," Duke University, Durham, NC, May 2023.

5. MEC/DARPA Next-generation Carbon Nanotube Electronics Workshop, "Opening new paths for printed electronics with carbon nanotubes," virtual meeting, June 2022.

6. Guadalupe Workshop X on Single Wall Carbon Nanotubes & Related Materials, "Nanoscale carbon for print-in-place and recyclable electronics," Flying L Ranch Resort, Bandera, TX, May 2022.

7. 2D Materials Summer School, "2D material devices," Univ. Minnesota, Minneapolis, MN, June 2018. (video: https://youtu.be/t1I6nNKrc4w)

8. International Workshop on 2D Atomic Sheets, "Harnessing the Unique Usefulness of 2D Materials Through Scaling, Stacking, and Printing," College Park, MD, July 2017.

9. 1st International Workshop on Data-Abundant System Technology, "Latest advancements toward a carbon nanotube transistor technology," Stanford University, Palo Alto, CA, Apr. 2014.

10. Lithography Workshop, "Patterning needs and obstacles for a sub-10 nm carbon nanotube transistor technology," La Quinta, CA, Nov. 2013.

11. CNTs for Digital Electronics Workshop, "Scaling and variability," NIST, Gaithersburg, MD, Sept. 2012.

Universities:

1. Brigham Young University ECE Department Seminar, "Using nanomaterials for shrinking, printing, and recycling future transistors," Provo, UT, Nov. 2023.

2. Michigan State University Inorganic Seminar Speaker for Chemistry Department, "Print-in-place and recyclable electronics from nanomaterials," East Lansing, MI, Mar. 2022.

3. Indian Institute of Technology – Kharagpur (IIT-K), "A new era of electronics using nanomaterials," Kharagpur, India, Nov. 2019.

4. Indian Institute of Technology - Bombay (IIT-B), "A new era of electronics using nanomaterials," Mumbai, India, Nov. 2019.
5. NC State Mechanical & Aerospace Engineering (MAE) Seminar, "Scaling and printing electronics using nanomaterials," Raleigh, NC, Sept. 2019.
6. Peking University, "Scaling and printing electronics using nanomaterials," Beijing, China, Mar. 2019.
7. Indraprastha Institute of Information Technology – Delhi (IIIT-D), "Carbon nanotubes for printed electronics applications," New Delhi, India, Oct. 2018.
8. Jaypee Institute of Information Technology (JIIT), "Carbon nanotubes for printed electronics applications," New Delhi, India, Oct. 2018.
9. Nanjing University, "Scaling, printing, and detecting: How nanomaterials still hold promise for electronics," Nanjing, China, Mar. 2018.
10. Zhejiang University, "Scaling, printing, and detecting: How nanomaterials still hold promise for electronics," Hangzhou, China, Mar. 2018.
11. Shanghai Jiao Tong University, "Scaling, printing, and detecting: How nanomaterials still hold promise for electronics," Shanghai, China, Mar. 2018.
12. ORaCEL Seminar, "Scaling, stacking, and printing: How nanomaterials still hold promise for a new era of electronics," NC State, Raleigh, NC, Sept. 2017.
13. Brigham Young University, "Scaling, printing, and sensing: A new era for electronics made possible using nanomaterials," Provo, UT, Oct. 2016.
14. Phi Theta Kappa Honors Society General Meeting, "How the world works: Global perspectives," Mesa Community College, Mesa, AZ, Mar. 2016.
15. University of Minnesota, "Promises, problems, and practicalities for nanomaterials in transistors," Minneapolis, MN, Mar. 2016.
16. University of Notre Dame, "Promises, problems, and practicalities for nanomaterials in transistors," South Bend, IN, Jan. 2016.
17. Eindhoven University of Technology, "What role will nanomaterials play in electronics?" Eindhoven, Netherlands, Sept. 2015.
18. North Carolina State University, "What role will nanomaterials play in electronics?" Raleigh, NC, June 2015.
19. University of North Carolina at Chapel Hill, "What role will nanomaterials play in electronics?" Chapel Hill, NC, Apr. 2015.
20. Columbia University, "Next generation transistors: Where do carbon nanotubes fit in?," New York, NY, Mar. 2014.
21. Duke University, "Next generation transistors: Where do carbon nanotubes fit in?," Durham, NC, Feb. 2014.
22. Purdue University, "The road ahead for carbon nanotube transistors," West Lafayette, IN, Jun. 2013.
23. Arizona State University, "The road ahead for transistors," Tempe, AZ, Jun. 2013.
24. Stanford University, "Carbon nanotube transistor technology—Are we there yet?!," Palo Alto, CA, Apr. 2013.
25. University of California-Berkeley, "Digital technology from carbon nanotube transistors," Berkeley, CA, Apr. 2013.
26. Georgia Institute of Technology, "Carbon Nanotubes—Why They're Still Worth Pursuing for Next-Generation Transistors", Atlanta, GA, Mar. 2012.
27. University of Notre Dame, "Carbon nanotube transistors: The future?", Notre Dame, IN, Mar. 2009.
28. Arizona State University, "Toward manufacturable vertical carbon nanotube nanoelectronic devices," Tempe, AZ, Nov. 2008.

Industry & Gov't Labs:

1. Hummink, "Fully printed submicron carbon nanotube thin-film transistors with Hummink's NAZCA printer," virtual webinar, Jun. 2024.
2. Air Force Research Laboratory (AFRL), "Print-in-place and recyclable electronics using mixed-dimensional nanomaterials," virtual department seminar, Jun. 2021.
3. Taiwan Semiconductor Manufacturing Company (TSMC), "From the top or through the edge: What is the most scalable contact to 2D semiconductors?" virtual corporate research seminar, Mar. 2021.
4. Illumina, "Progress toward electronic biomedical sensing from printable nanomaterials," San Diego, CA, Feb. 2019.
5. Army Research Laboratory (ARL), "Scaling and printing electronics using nanomaterials" Adelphi, MD, Aug. 2018.
6. Palo Alto Research Center (PARC), "Harnessing the versatility of carbon nanotubes for printed electronics," PARC, Palo Alto, CA, Dec. 2017.
7. Illumina, "Scaling, printing, and sensing: A new era for electronics made possible using nanomaterials," San Diego, CA, Jan. 2017.
8. IBM T. J. Watson Research Center, "Scaling, printing, and sensing: A new era for electronics made possible using nanomaterials," Yorktown Heights, NY, July 2016.
9. Illumina, "The pillars of nanomaterial-enabled devices: Purity, placement, and performance," San Diego, CA, Aug. 2015.
10. Army Research Laboratory (ARL), "Nanomaterials in the Next Switch?" Adelphi, MD, Apr. 2015.
11. National Institute of Advanced Industrial Science and Technology (AIST), "The road ahead for transistors: Where do carbon nanotubes fit in?," Tsukuba, Japan, Sept. 2013.
12. IBM Materials Research Community, "Promises and Challenges for Achieving a Digital Technology with Carbon Nanotube Transistors," Yorktown Heights, NY, Mar. 2012.
13. IBM T. J. Watson Research Center, "Templated vertical carbon nanotubes for nanoelectronics," Yorktown Heights, NY, Sept. 2008.

Grants and Sponsored Research Projects (*Total since 2015: $9,792,621*)

External:

Active:

1. PI: **A. D. Franklin**; co-PI: M. Luisier (ETH-Zurich), "NSF-SNSF: Uncovering the thermal implications of contact scaling and structure in 2D semiconductors," *NSF-Swiss NSF Lead Agency Opportunity*
   $400,000: Sep. 2024 – Aug. 2027
2. PI: **A. D. Franklin**; co-PIs: J. Kymissis (Columbia), M. Therien, M. Wiesner, "LEAP-HI: All-Carbon Recyclable Electronics (ACRE): Realizing a Sustainable Electronics Lifecycle," *NSF Leading Engineering for America's Prosperity, Health, and Infrastructure (LEAP HI)*
   $500,000: Sep. 2023 – Aug. 2025
3. PI: T. Roy; co-PIs: **A. D. Franklin**, H. Li, "FuSe: Co-designed Systems for In-sensor Processing with Sustainable Nanomaterials (COSMIC)," *NSF Future of Semiconductors (FuSe)*
   $1,376,180: Aug. 2023 – Jul. 2026
4. PI: S. Koduri; co-PI: **A. D. Franklin**, "Biodegradable Electronic Sensors to Measure Environmental Data for Perishable Goods," *NSF STTR Phase I*
   $274,147: Apr. 2023 – Mar. 2025
5. PI: **A. D. Franklin**, "Exploring the Limits of Scaling and 3D-integration for Edge-contacted Nanomaterial-based Transistors," *NSF EPMD*
   $398,671: Sep. 2022 – Aug. 2025
6. PI: **A. D. Franklin**; co-Is: R. Karra, A. B. Nixon, C. F. Pieper, A. Chilkoti, C. Kontos, "Printed electronic biosensors for point-of-care testing of cardiovascular biomarkers," *NIH R01, NHLBI*
   $2,704,158: Apr. 2019 – Mar. 2025

Completed:

1. PI: S. Noyce; co-I: **A. D. Franklin**, "Versametrics STTR Matching Grant," *One NC Small Business Program*

$75,000: Mar. 2022 – Mar. 2023

2. PI: **A. D. Franklin**; co-PI: S. G. Noyce, "Enabling Study of Electrically Transduced Information from Biomolecules with a Low-cost, Versatile Measurement (Versametrics) System," *NIH R41 STTR, NIBIB*
   $250,000: Sep. 2021 – Sep. 2022
3. PI: **A. D. Franklin**, "1D edge contacts to 2D devices for scalability and 3D integration with via-formed junctions," *NSF EPMD*
   $390,657: Jul. 2019 – Jun. 2022
4. PI: A. Chilkoti; co-PIs: **A. D. Franklin**, J. Rogers, "Point-of-care testing to improve monitoring of LVAD patients," *NIH R21, NHLBI*
   $417,260: Jun. 2018 – May 2020
5. PI: **A. D. Franklin**, "Exploration of materials and geometries for understanding printed thickness sensors," *Tyrata, Inc.*
   $46,000: Jan. 2018 – Jul. 2020
6. PI: A. Chilkoti; co-PI: **A. D. Franklin**, "A Point-of-Injury Screening Assay for Tactical Damage Control Resuscitation," *CDMRP: Defense Medical Research and Development, JPC-6 Combat Casualty Care Research Program*
   $1,500,000: Sept. 2017 – Sept. 2020
7. PI: **A. D. Franklin**, "Arrays of nanowire transistors: Fabrication and device performance," *Illumina, Inc*
   $450,000: Apr. 2016 – Apr. 2019
8. PI: D. Wang; co-PI: **A. D. Franklin**, "High linearity RF amplifiers from carbon nanotubes," *ARO STTR*
   $150,000: Jan. 2019 – Jun. 2019
9. PI: **A. D. Franklin**, "1.2.2 Nanoelectronics and nanosensors for Army applications: Exploring the vertical to plane electronic properties of layered two-dimensional materials," *Army Research Lab (ARL)*
   $35,000: Sept. 2016 – Aug. 2017
10. PI: **A. D. Franklin**, "EAGER: Exploring the Negative Capacitance Effect from Hf-based Ferroelectrics and 2D Nanomaterials for Low-Voltage Transistors," *National Science Foundation (NSF)*
    $150,000: Oct. 2016 – Sept. 2018
11. PI: **A. D. Franklin**, "Engineering Atomic Layer Deposited Contact Interfaces to Low-Dimensional Nanomaterials for Improved Scaled Transistor Performance," *National Science Foundation (NSF)*
    $358,086: June 2015 – May 2018
12. PI: **A. D. Franklin**; co-PI: M. Brooke, "Nanomaterial-Enabled Printed Electronics for Advanced Tire Monitoring System," *Fetch Automotive Design Group, LLC*
    $380,998: July 2015 – Apr. 2017

Duke Internal:

1. PI: T. Roy; co-PIs: **A. D. Franklin**, Y. Chen, M. Wiesner, H. Wang, H. Li, "Independent Neural Network Enabled Recyclable AI (INNER-I) Center for Environment-friendly Low-cost Printed Neuromorphics," *Duke Pratt Beyond the Horizon Program Phase II*
   $350,000: Jul. 2024 – Jun. 2025
2. PI: T. Roy; co-PIs: **A. D. Franklin**, Y. Chen, "Independent Neural Network Enabled Recyclable AI (INNER-I) Center for Environment-friendly Low-cost Printed Neuromorphics," *Duke Pratt Beyond the Horizon Program Phase I*
   $150,000: Jul. 2023 – Jun. 2024
3. PI: **A. D. Franklin**; co-PIs: F. Yuan, J. Campbell, "Direct-printed On-Skin Electronic Drug-delivery (DOSED) for GLP-1RA Therapy," *Duke DST Launch Seed Grant*
   $100,000: Sep. 2022 – Aug. 2023
4. PIs: **A. D. Franklin**, D. Mitzi, "Development of Low-Electron Affinity Buffer Layers for High Performance Earth-Abundant Solar Cells," *Duke Energy Research Seed Funding*
   $39,864: Jul. 2017 – Jun. 2018
5. PI: **A. D. Franklin**, "Understanding and Accessing the Ultra-sensitivity of Carbon Nanotubes," *Duke School of Medicine (SOM) Facility Voucher Program*
   $9,000: Jan. 2017 – Dec. 2017

6. PI: **A. D. Franklin**; co-PIs: M. Therien, J. Liu, "Printing Electronic Circuits Using Nanomaterial Inks," *Duke Pratt Seed Fund*
   $37,600: Nov. 2014 – Nov. 2015

Advising & Mentorship

PhD Students Currently Advising

1. **Sarah Evans** – NSF Fellow (Fall 2024 – present)
   - Research area: Contacts and scaling of 2D semiconductor-based transistors
   - Prior to Duke: B.S. in Electrical & Computer Engineering (UT-Dallas) and Analog IC Design Intern at TI
2. **Rowena Ge** (Fall 2024 – present)
   - Research area: Printed nanomaterials-based biomedical devices
   - Prior to Duke: B.S. in Chemical Engineering (Lafayette College)
3. **Kashish Malhotra** (Fall 2024 – present)
   - Research area: Printed electronics for displays
   - Prior to Duke: B.S. in Electrical, Electronics, and Communications Engineering (RV College) and Engineeer at Qualcomm
4. **Samantha Holmes** (Fall 2023 – present)
   - Research area: Thermal effects of transport at contacts to 2D semiconductors
   - Prior to Duke: B.S. in Materials Science Engineering (NC State), B.S. in Biological Sciences (NC State)
5. **Victoria Ravel** (Fall 2023 – present)
   - Research area: Contact gating effects in 2D semiconductor-based transistors
   - Prior to Duke: B.S. in Biomedical Engineering (George Washington University)
6. **Brian Cole** (Fall 2021 – present)
   - Research area: Direct-write printing of nanomaterial-based inks for electronics
   - Prior to Duke: M.S. in Materials Science Engineering (Clemson), B.S. in Computer Science (Western Governor's University), and B.S. in Chemistry (Henderson State University)
7. **Baiyu Zhang** (Fall 2020 – present)
   - Research area: Printed MXene for Thin-film Transistors and Neuromorphic Synapses
   - Prior to Duke: B.S. in Electrical Engineering (University of Louisiana)
8. **Hansel (Alex) Hobbie** (Fall 2019 – present, co-advised with P. Maccarini, ECE)
   - Research area: Flexible thermal sensors for in vivo monitoring
   - Prior to Duke: B.S. in Electrical Engineering (Rose-Hulman Institute of Technology)
9. **Jay Doherty** (Fall 2018 – present)
   - Research area: Characterization capabilities and studies of nanoscale electronic devices and sensors
   - Prior to Duke: B.S. in Electrical Engineering (Duke)

PhD Graduates Advised

10. **Dr. Brittany Smith** (2024)
    - Dissertation: "Carbon-based inks and printing processes for environmentally friendly sensors and transistors"
    - First Job: Postdoc at Duke, preparing for faculty position
    - Currently: Postdoc at Duke, preparing for faculty position
11. **Dr. Faris Albarghouthi** (2024)
    - Dissertation: "Addressing scalability, stability, and sensitivity in nanomaterial-based electronic biosensors"
    - First Job: Research Engineer at Wolfspeed
    - Currently: Research Engineer at Wolfspeed
12. **Dr. Brittani (Carroll) Huegen** (2024)
    - Dissertation: "Customized electrodes for printed biosensors and wearable electronics"
    - First Job: Research Engineer at Air Force Research Lab (AFRL)
    - Currently: Research Engineer at Air Force Research Lab (AFRL)
13. **Dr. Shiheng Lu** (2022)
    - Dissertation: "Aerosol jet printing of carbon nanotube thin-film transistors"
    - First Job: Research Engineer at Huawei
    - Currently: Research Engineer at Huawei
14. **Dr. Hattan Abuzaid** (2022)

- Dissertation: "On the impact of materials and processes on edge-contacted 2D transition metal dichalcogenide transistors"
- First Job: Postdoctoral Researcher at Argonne National Lab
- Currently: Consulting Senior Manager at KAPSARC in Saudi Arabia

15. **Dr. Nicholas Williams** (2021)
    - Dissertation: "Custom inks and printing processes for electronic biosensing devices"
    - First Job: Postdoctoral Researcher at Northwestern University
    - Currently: VP of Technology at X-COR Therapeutics and President at InFlo Medical
16. **Dr. Jorge Cardenas** (2020)
    - Dissertation: "In-place printing of carbon nanotube transistors at low temperature"
    - First Job: Postdoctoral Researcher at Sandia National Lab
    - Currently: Postdoctoral Researcher at Sandia National Lab
17. **Dr. Yuh-Chen Lin** (2020)
    - Dissertation: "Two-dimensional negative capacitance FETs with ferroelectric $HfZrO_2$"
    - First Job: Applied Scientist at Amazon
    - Currently: Research Scientist at Meta
18. **Dr. Steven Noyce** (2020)
    - Dissertation: "Mapping sensitivity of nanomaterial field-effect transistors"
    - First Job: Senior Scientist at Tyrata
    - Currently: Senior Scientist at Tyrata / Bridgestone and CEO at Versametrics
19. **Dr. Joseph Andrews** (2019)
    - Dissertation: "Printed carbon nanotube thin films for electronic sensing"
    - First Job: Assistant Professor at University of Wisconsin-Madison
    - Currently: Assistant Professor at University of Wisconsin-Madison
20. **Dr. Zhihui Cheng** (2019)
    - Dissertation: "Modification and scaling of metal contacts to 2D materials using an in-situ argon ion beam"
    - First Job: Postdoctoral Researcher at National Institute for Standards and Technology (NIST)
    - Currently: Research Engineer at Intel Corporation
21. **Dr. Katherine (Price) Ferguson** (2019)
    - Dissertation: "On the impact and growth of plasma-enhanced atomic layer deposition high-k dielectrics on 2D crystals"
    - First Job: Postdoctoral Researcher at Army Research Laboratory (ARL)
    - Currently: Research Scientist at Army Research Laboratory (ARL)
22. **Dr. Daniel J. Joh** (2018, co-advised with A. Chilkoti, BME)
    - Dissertation: "Molecular and biofunctional modification of conformal POEGMA bottlebrush coatings and applications toward in vitro diagnostics"
    - First Job: MD Resident at Duke
    - Currently: MD Resident at Duke
23. **Dr. Felicia McGuire** (2018)
    - Dissertation: "Two-dimensional molybdenum disulfide negative capacitance field-effect transistors"
    - First Job: Field Application Engineering at Oxford Instruments Plasma Technology
    - Currently: Field Applications Engineer at Lam Research

Masters Graduates Advised

1. **Nicolas Chen** (2023)
    - Research area: Nanocellulose varieties for printed ionic dielectrics
2. **Alexander Mangus** (2022)
    - Research area: Unexpected polarity switch in WS_2-based Ar^+ ion beam-modified devices
3. **Hope Meikle** (2022)
    - Research area: Analyzing performance of carbon-based aerosol jet printed transistors through optimization of the ink's materials
4. **Shulin Ye** (2021)
    - Research area: Direct-write printing of epoxy-based material for printed biosensor passivation

Undergraduate Student Researchers Advised (alphabetical by last name)

Semester Projects: *Danny Badia* (2023-2024), *Peter Ballentine* (2017-2022), *Matthew Barbano* (2016-2020), *Eeshta Bhatt* (2022–present), *Nathaniel Brooke* (2018-2020), *Nathan Choe* (2018-2021), *Isabel Dudlyke* (2024), *Simon Gorbaty* (2021-2022), *Josh Guthrie* (2024), *Aneesh Karappur* (2021-2022), *Lauren Kenselaar* (2024), *Minha Kim* (2024), *CJ Lim* (2017-2018), *Quentin MacFarlane* (2022–2024), *Josh Medway* (2020-2022), *James Mu* (2023-2024), *Jacob Mullett* (2016-2017), *Maya Parekh* (2021), *Brendan Peercy* (2021), *Xiongxiong Pei* (2021-2024), *Matthew Salfity* (2022-present), *Spencer Schutz* (2021), *Shreya Singh* (2017-2019), *Max Smith* (2018-2019), *Nate Watson* (2017-2019), *Justin Wang* (2018-2019), *Ryan Wence* (2021-2023), *Chandler Wimmer* (2024), *Tom Wu* (2015-2016), *Joseph Zhang* (2021), *Joanne Zheng* (2018-2020)

Summer REUs: *Anna Bethke* (2024), *Jorge Cardenas* (2015), *Favour Dada* (2018), *Zoe Fowler* (2019), *Alex Hobbie* (2018), *Cesar Lasalde Ramirez* (2019), *Iman Khanani* (2022), *Abhinay Kumar* (2015), *Jugal Mehta* (2017), *Vipin Prajapati* (2016), *Max Rawlings* (2024), *Kirstin Schauble* (2016), *Sophia Upshaw* (2017), *Rubimarie Vasquez* (2022)

PhD Examination Committees (chronological)

Final Defense: *Faris Albarghouthi* (Jul. 2024), *Natalie Rozman* (Mar. 2024), *Brittani Huegen* (Mar. 2024), *Anjing Huang* (Nov. 2023), *Divya Pande* (Jul. 2023), *Yongshin Kim* (Mar. 2023), *Xiuyuan Peng* (Mar. 2023), *Kathleen Horvath* (Aug. 2022), *Shiheng Lu* (Jul. 2022), *Yunjiao Pu* (Jul. 2022), *Andrew Boyce* (Jun. 2022), *Shruti Preetam* (May 2022), *Yaas Bigdeli* (Apr. 2022), *Hattan Abuzaid* (Mar. 2022), *Huayu Tong* (Mar. 2022), *Xin Song* (Oct. 2021), *Nicolas Williams* (Mar. 2021), *George Bullard* (Nov. 2020), *Yuh-Chen Lin* (Aug. 2020), *Tasso von Windheim* (July 2020), *Fan Wang* (July 2020), *Jorge Cardenas* (July 2020), *Steven Noyce* (July 2020), *Spencer Ferguson* (July 2020), *Wade Wilson* (June 2020), *Callie Woods* (June 2020), *Aditi Dighe* (Mar. 2020), *Shalin Shah* (Mar. 2020), *Mutya Cruz* (Nov. 2019), *Vinay Gowda* (Aug. 2019), *Ben Lariviere* (Jul. 2019), *Zhihui Cheng* (Jun. 2019), *Joseph Andrews* (Jun. 2019), *Katherine Price* (Apr. 2019), *Wiley Dunlap-Shohl* (Mar. 2019), *Christopher Reyes* (July 2018), *Qiwei Han* (June 2018), *Daniel Joh* (Apr. 2018), *Matthew Catenacci* (Mar. 2018), *Felicia McGuire* (Mar. 2018), *Ugonna Ohiri* (Mar. 2018), *Xinyu Liu* (July 2017), *David Miller* (Nov. 2016), *Liji Chen* (June 2016), *Erich Radauscher* (Apr. 2016)

Preliminary Exams: *Greg Hernandez* (May 2024), *Deniz Acil* (May 2024), *Brian Cole* (Apr. 2024), *Nicolas Ramos* (Apr. 2024), *Avery Vigil* (Apr. 2024), *Elizabeth Jacobia* (Mar. 2024), *Baiyu Zhang* (Nov. 2023), *Morgan Heckman* (Sep. 2023), *Dmitrii Tsvetkov* (Apr. 2023), *Liangze Cui* (Apr. 2023), *Hengming Li* (Apr. 2023), *Brittany Smith* (Mar. 2023), *H. Alex Hobbie* (Oct. 2022), *Buang Zhang* (May 2022), *Faris Albarghouthi* (Apr. 2022), *Jiaxin Ye* (Apr. 2022), *Anjing Huang* (Apr. 2022), *Xiuyuan Peng* (Nov. 2021), *Jay Doherty* (Jul. 2021), *Shiheng Lu* (May 2021), *Brittani Carroll* (Apr. 2021), *Yongze Jia* (Apr. 2021), *Yunjiao Pu* (Apr. 2021), *Nicolas Lozada-Smith* (Apr. 2021), *Yongshim Kim* (Jan. 2021), *Niara Wright* (Dec. 2020), *Natalie Rozman* (Dec. 2020), *Hattan Abuzaid* (Nov. 2020), *Francesco Mastrocinque* (Oct. 2020), *Chengjie Mao* (Oct. 2020), *Nick Williams* (May 2020), *Yaas Bigdeli* (Apr. 2020), *Divya Pande* (Apr. 2020), *Kat Horvath* (Mar. 2020), *Xander Deputy* (May 2019), *Shruti Preetam* (May 2019), *Shan Yang* (May 2019), *Xing He* (May 2019), *Andrew Boyce* (Apr. 2019), *Spencer Ferguson* (Apr. 2019), *Jorge Cardenas* (Apr. 2019), *Tomas Barraza* (Apr. 2019), *Huayu Tong* (Mar. 2019), *Steven Noyce* (Dec. 2018), *Yuh-Chen Lin* (Dec. 2018), *Fan Wang* (Nov. 2018), *Haibei Zhu* (Nov. 2018), *Katherine Price* (Aug. 2018), *Shalin Shah* (May 2018), *Wade Wilson* (May 2018), *Joseph Andrews* (Apr. 2018), *Tasso von Windheim* (Feb. 2018), *Xin Song* (Nov. 2017), *Zhihui Cheng* (Sept. 2017), *Jimmy Thostenson* (July 2017), *Wiley Dunlap-Shohl* (June 2017), *Felicia McGuire* (May 2017), *Callie Woods* (Apr. 2017), *Mutya Cruz* (Apr. 2017), *Xinyu Liu* (Sept. 2016), *Ugonna Ohiri* (June 2016), *Daniel Joh* (May 2016), *Christopher Reyes* (Apr. 2016), *George Bullard* (Apr. 2016), *Qiwei Han* (Apr. 2015), *Lianjun Ellie Zheng* (Apr. 2015), *Matthew Catenacci* (Apr. 2015), *Erich Radauscher* (Mar. 2015)

Qualifying Exams: *Sazzadur Rahman* (Mar. 2024), *Deniz Acil* (Apr. 2022), *Brian Lerner* (Apr. 2022), *Nicky Ramos* (Apr. 2022), *Siyuan Zhang* (May 2021), *Buang Zhang* (Dec. 2020), *Jiaxin Ye* (Apr. 2020), *Xiuyuan Peng* (May 2019), *Natalie Rozman* (Mar. 2019), *Mariana Vasquez* (Dec. 2018), *Tomas Barraza* (Nov. 2017), *Haibei Zhu* (Nov. 2017), *Evan Stump* (Nov. 2017), *Xander Deputy* (Nov. 2017), *Jorge Cardenas* (Oct. 2017), *Shruti Preetam* (Oct. 2017), *Spencer Ferguson* (Oct. 2017), *Wade Wilson* (May 2017), *Fan Wang* (Apr. 2017), *Raul Vyas* (Dec. 2016), *Steven Noyce* (Dec. 2016), *Philip Herr* (Dec. 2016), *Xin Song* (Dec. 2016), *Tasso von Windheim* (Nov. 2016), *Zhongxi Li* (Nov. 2016), *Yuh-Chen Lin* (Nov. 2016), *Katherine Price* (June 2016), *Wiley Dunlap-Shohl* (June 2016), *Jimmy Thostenson* (Apr. 2016), *Zhihui Cheng* (Feb. 2016), *Laura Pulido* (Oct. 2015), *Callie Woods* (Sept. 2015), *Felicia McGuire* (Apr. 2015)

Academic and Professional Service

Academic Committees

Duke-wide

- **Marcil-Monahan Scholars Review & Selection Committee:** *Member* (Spring 2024)
- **Committee on Reference Checking Practices for Faculty Hiring:** *Member* (Spring 2024)
- **Provost's Advisory Committee on Appointments, Promotion, and Tenure (APT)**: *Appointed member* (Jan. 2023 – Dec. 2023)
    - Standing committee handling all appointment, promotion, and tenure cases for Duke University

- **Misconduct in Research Committee**: *Appointed member* (Sept. 2017 – Aug. 2020)
- **Academic Council**: *Elected member* (Aug. 2015 – Aug. 2017)

Pratt School of Engineering

- **Search Committee for Director of Institute for Enterprise Engineering (IEnE):** *Chair* (Fall 2024)
- **Selection Committee for SMIF Executive Director:** *Chair* (Fall 2024)
- **Undergraduate Program Enhancement Fund (UPEF) Review & Selection Committee**: *Member* (Fall 2024, Fall 2023)
- **Thomas Lord Education Initiative Grant Program Review & Selection Committee:** *Member* (Spring 2024, Spring 2023)
- **I/O Magazine Faculty Advising Board:** *Member* (2023-present)
- **Envisioning the Invisible Contest for SMIF – Selection Committee:** *Member* (Spring 2024, Spring 2023, Spring 2022)
- **Engineering Faculty Council:** *Elected member* (Aug. 2015 – Aug. 2017)

ECE Department

- **Microelectronics, Photonics, Nanotechnology (MPN) Group:** *Group leader* (2022-present)
- **Space Committee:** *Member* (Fall 2023-present)
- **Faculty Search Committee in Semiconductor Technology:** *Chair* (AY 2023-2024)
- **ECE Strategic Vision Committee:** *Member* (2022-2024)
- **Faculty Search Committee for DST**: *Chair* (AY 2021-2022)
- **ECE Strategic Plan Development Committee**: *Member* (Fall 2021)
- **Financial Oversight Committee**: *Member* (Jun. 2018 – 2020)
- **Graduate Studies Committee (GSC)**: *Member* (Sept. 2017 – Jun. 2021)
- **Undergraduate Studies Committee (UGSC):** *Member* (Sept. 2016 – Aug. 2017)
- **TOP ECE Faculty Recruitment Committee:** *Member* (Spring 2017 – Fall 2019)
- **ECE Diversity Committee:** *Member* (Spring 2017 – 2021)
- **ECE Staff Assistant Hiring Committee:** *Member* (Apr. 2015)

Chemistry Department

- **Research Propositional Examination Committee:** *Member* (Fall 2018)
- **Regular Rank Non Tenure Track Faculty Development:** *Member* (2017-2018)
- **Research Propositional Examination Committee:** *Member* (Fall 2015)
- **Research Faculty Committee:** *Member* (2015 – 2016)

Miscellaneous

- **Shared Materials Instrumentation Facility (SMIF) Advisory Committee:** *Member* (Aug. 2015 – present)
- **Search Committee for Dean of The Graduate School at Duke:** *Member* (Spring 2022)
- **Pratt Dean Search Engineering Faculty Council Committee:** *Member* (Nov. – Dec. 2015)
- **Dean's Award for Excellence in Mentoring Selection Committee:** *Member* (Dec. 2015)

Journals & Proposals

Editorial Advisory Board Member: *ACS Applied Nano Materials* (2017 – present)

Journal Reviewer: *Science, Nature, Nature Nanotechnol., Nature Electronics, Nature Mater., Nature Comm., Nano Lett., ACS Nano, ACS Appl. Mater. Interfaces, ACS Appl. Nano Mater., ACS Appl. Electronic Mater., Sci. Adv., Sci. Rep., Appl. Phys. Lett., Adv. Mater., Adv. Func. Mater., Adv. Electronic Mater., Adv. Mater. Interfaces, PLOS One, IEEE Trans. Nanotechnol., IEEE Electron Device Lett., IEEE Trans. Electron Devices, Nanotechnology, Thin Solid Films, J. Phys. D: Appl. Phys., MRS Proceedings, New J. Phys., J. Phys. Chem., J. Electronic Mater., Surface Rev. Lett., Mater. Chem. Phys., Physica B: Condensed Matter, Nanoscale Res. Lett., MRS Comm., J. Computational Electronics, Appl. Phys. A, Semicond. Sci. Technol., Nano Res., 2D Mater., IEEE Sensors J.*

Grant/Proposal Reviewer: *National Science Foundation* (since 2011), *National Institutes of Health* (since 2019)

Conference Organization

President of the Board of Directors (elected position): *Device Research Conference, Inc.* (2018 – present)

- Manage the DRC meeting organization, including leadership appointments, financial management, etc.

General Chair: *76th Device Research Conference – DRC* (2018)

- Supervised all conference organization efforts for international meeting of 300+ attendees.

Technical Program Chair: *75th Device Research Conference – DRC* (2017)

- Directed all conference organization efforts for historic 75th anniversary international meeting of 300+ attendees, including planning of technical sessions, inviting renowned plenary speakers, arranging for student travel and awards, planning and leading technical program committee, and so forth.

Technical Program Vice-Chair: *74th Device Research Conference – DRC* (2016)

- Contributed to all conference organization efforts for international meeting of 300+ attendees.

Subcommittee Chair: *International Electron Device Meeting (IEDM), Nano Device Technology* (2017)

Technical Program Committee Member: *International Electron Device Meeting – IEDM* (2014 – 2017), *Device Research Conference – DRC* (2012 – 2018), *International Conference on Electron, Ion, and Photon Beam Technology and Nanofabrication – EIPBN* (2014 – 2016), *IEEE Photonics Society Summer Topical Meeting* (2015), *Gordon Research Conference – Nanostructure Fabrication* (2014)

Session/Symposium Organizer: *TechConnect Nanoelectronics Section* (June 2015), *Materials Research Society – MRS* (Spring 2022, Fall 2014, Fall 2012), *Applied Physics Society Meeting – APS* (March 2013), *IEEE International Conference on Nanotechnology – IEEE Nano* (Aug. 2013)

Short Course Organizer: *Device Research Conference – DRC* (2013, "2D Materials Beyond Graphene")

Workshop Co-organizer: *Carbon Nanotubes for Digital Electronics Workshop @ NIST* (2012)

IBM Physical Science Department Seminar Chair (2011 – 2013)

<u>Prior to Duke</u>

Corporate Liaison from IBM: *SRC-GRC Task at Georgia Tech* (2010 – 2014), *Nanoelectronics Research Initiative (NRI) funded centers* (2010 – 2013)

Purdue University ECE Graduate Committee Member 2008

Birck Nanotechnology Center Student Advisory Councilmember, Purdue University 2006 – 2008

Graduate Student Mentor to Undergraduate Research Fellows, Purdue University 2006 – 2007

Professional Societies

- Institute of Electrical and Electronics Engineers (IEEE)
  - Fellow (2024 – present)
  - Senior Member (2015 – 2023)
  - Member (2005 – 2015)
- National Academy of Inventors (NAI)
  - Fellow (2025 – present)
- Materials Research Society (MRS)
  - Member (2006 – present)
- American Chemical Society (ACS)
  - Member (2014 – present)
- Electrochemical Society (ECS)
  - Member (2017 – present)

Research and Professional Experience

Versametrics, LLC, Durham, NC 2020 – Present
Co-Founder & Scientific Director

- Start-up company based on technology from my Duke research lab for versatile electrical measurement systems.
- Successfully captured Phase 1 STTR funding from NIH-NIBIB.

Tyrata, Inc., Durham, NC 2017 – 2023
Co-Founder & Chief Technology Officer (CTO)

- Start-up company based on technology from my Duke research lab for printed tire tread wear sensors.
  - **Company acquired by Bridgestone**, one of the largest tire manufacturers in the world, in late 2023. See here: https://pratt.duke.edu/news/duke-spinoff-tyrata-acquired-by-bridgestone/
- Helped secure series A funding of $4.5M to start company (2017) followed by series A1 of $2.8M (2020) and additional strategic investment from Bridestone Americas (2022).
- Led intellectual property generation and protection efforts.
- Maintained technology roadmap and competitive technology analysis.

Duke University, Durham, NC
Addy Professor, Departments of ECE and Chemistry 2020 – Present
James L. & Elizabeth M. Vincent Associate Professor, Departments of ECE and Chemistry 2018 – 2020
Associate Professor, Departments of Electrical & Computer Engineering (ECE) and Chemistry 2014 – 2018

- Supervise, advise, and mentor students towards the completion of their degrees. Alums include:

- **PhD (9):** Nicholas X. Williams (Spring 2021), Yuh-Chen Lin (Fall 2020), Jorge Cardenas (Summer 2020), Steven Noyce (Summer 2020), Joseph Andrews (Spring 2019), Zhihui Cheng (Spring 2019), Katherine Price (Spring 2019), Felicia McGuire (Spring 2018), Daniel Joh (co-advised with A. Chilkoti (BME), Spring 2018)

- Direct research program on nanoelectronics and printed electronic devices for diverse applications.
- Support the teaching mission of the university in both undergraduate and graduate education.
- Serve the academic community through committee work, both research and administrative in nature.
- Establish and maintain international recognition for students/research coming out of the lab.

IBM, T. J. Watson Research Center, Yorktown Heights, NY
Research Staff Member 2008 – 2014

- Investigated low-dimensional materials for electronics applications.
- Developed integration processes for carbon nanotubes and graphene into nanoelectronic devices.
- Studied and improved scaling behavior in carbon nanotube and graphene devices.
- Explored application of carbon nanotubes to supercapacitor electrodes.
- Studied thin-film transistors from carbon nanotubes and graphene for flexible electronics applications.
- Implemented carbon nanotubes and/or graphene for electrodes in photovoltaic cells.

Purdue University, Birck Nanotechnology Center, School of Electrical and Computer Engineering, West Lafayette, IN
NSF Fellow, PhD Student 2005 – 2008

- Developed process for nanowire growth by penetrating alumina barrier in porous anodic alumina (PAA).
- Optimized electrodeposition process to achieve controlled formation of Pd nanocubes decorating CNTs for application in biosensors.
- Conducted extensive optimization studies on CNT synthesis using plasma-enhanced CVD.
- Designed and implemented technique for obtaining long-range ordered thin-film PAA.
- Developed process for embedding PAA in customizable patterns within SiO_2.
- Fabricated and characterized the first completely vertical two-terminal CNT devices.
- Established surround gates on vertical CNT channels.
- Developed process for straightforward control of CNT channel length for vertical nanoelectronics.

Intel Corporation, Chandler, AZ 2004 – 2005
Component Design Engineer

- Designed and validated various units for the Intel chipset projects.
- Implemented and enhanced skills in logic design, debugging, and project management.

Institute for Nanoelectronics and Computing, Purdue University, West Lafayette, IN
NASA Summer Undergraduate Research Intern 2004

- Studied effects of pre-growth catalyst annealing on CNT synthesis in plasma-enhanced CVD.
- Contributed to the design/characterization of modified PAA for synthesizing vertical CNT channels.

Honeywell, Phoenix, AZ 2003 – 2004
Electrical Engineer Intern (Automated Flight Controls Systems)

- Performed manual computer tests on various mixed signal designs.
- Sponsored by Corporate Leaders Program, which provided interaction with industry leaders and enhancement of communication and presentation skills through monthly activities.

Arizona State University, Department of Electrical Engineering, Tempe, AZ
Undergraduate Researcher 2003 – 2004

- Performed electrical characterization of solid-state ionic memory devices.

Teaching Experience

Duke University, Durham, NC 2014 – present
Addy Professor, Department of Electrical & Computer Engineering and Department of Chemistry

- *ECE 230L* – Fall 2024. Taught undergraduate core course on semiconductor physics & devices.
- *ECE 512* – Spring 2024. Updated and taught graduate-level course on nanoelectronic devices.
- *ECE 230L* – Fall 2023. Taught undergraduate core course on semiconductor physics & devices.
- *ECE/NANOSCI 511 (CHEM 611)* – Spring 2023. Taught graduate-level course on foundations of nanoscale science & technology.
- *ECE 230L* – Fall 2022. Taught undergraduate core course on semiconductor physics & devices.
- *ECE 512* – Spring 2022. Updated and taught graduate-level course on nanoelectronic devices.
- *ECE 230L* – Fall 2021. Taught undergraduate core course on semiconductor physics & devices.
- *ECE/NANOSCI 511 (CHEM 611)* – Spring 2021. Taught graduate-level course on foundations of nanoscale science & technology.

- *EGR 790* – Fall 2020. Developed and taught preparing future engineering faculty course for PhD students from all disciplines across the Pratt School of Engineering (enrollment of 80).
- *ECE 230L* – Fall 2020. Taught undergraduate core course on semiconductor physics & devices.
- *ECE 512* – Spring 2020. Updated and taught graduate-level course on nanoelectronic devices.
- *ECE 230L* – Fall 2019. Taught undergraduate core course on semiconductor physics & devices.
- *ECE/NANOSCI 511 (CHEM 611)* – Spring 2019. Taught graduate-level course on foundations of nanoscale science & technology.
- *ECE 230L* – Fall 2018. Revised & taught undergraduate core course on semiconductor physics & devices.
- *ECE 512* – Spring 2018. Updated and taught graduate-level course on nanoelectronic devices.
- *ECE 230L* – Fall 2017. Taught undergraduate core course on microelectronic devices & circuits.
- *ECE 230L* – Spring 2017. Taught undergraduate core course on microelectronic devices & circuits.
- *ECE/NANOSCI 511* – Spring 2017. Updated content for, developed, and taught graduate-level course on foundations of nanoscale science & technology.
- *ECE 230L* – Fall 2016. Taught undergraduate core course on microelectronic devices & circuits.
- *ECE 590.05* – Spring 2016. Updated and taught graduate-level course on nanoelectronic devices.
- *ECE 230L* – Fall 2015. Taught undergraduate core course on microelectronic devices & circuits.
- *CHEM 548* – Spring 2015. Developed and taught graduate-level course on solid-state materials/chemistry.
- *ECE 590.08* – Fall 2014. Developed and taught graduate-level course on nanoelectronic devices.

Columbia University, New York, NY 2013 – 2014
Adjunct Assistant Professor, Department of Electrical Engineering

- Developed and taught graduate-level courses on emerging and low-dimensional nanoelectronic devices.

Ivy Tech Community College, Lafayette, IN 2007 – 2008
Adjunct Faculty

- Taught undergraduate math courses, including all lecturing and grading.
- Received highest ratings in department from student reviews.

Community Service

IBM Mentor to High School Students 2011 – 2014
Pathways in Technology Early College High School (P-TECH)

- One-on-one mentoring of P-TECH students in STEM disciplines.

National Engineers Week Volunteer 2005, 2011 – present
Intel Corporation, IBM, Duke

- Judge local and national high school science fair projects.
- Visit high school science classes to motivate students to pursue careers in science and engineering.

High School Seminary Teacher 2001 – 2007

- Daily taught two high school seminary classes of 30+ students for four years.

Global Tech Leaders Symposium Delegate 2004
Corporate Leaders Program, Arizona State University

- Worked in diverse teams to provide technological service to communities in Singapore and Tokyo.

Boy Scouts of America Explorer Post Leader 2001 – 2003

- Led group of 15 boys through high-adventure activities and character-building merit badge classes.

Full-time Church Missionary 1998 – 2000