ROBERT A. NAWROCKI

Purdue University, West Lafayette, IN 47907, USA, (765) 494-5039
rnawroc@purdue.edu
https://polytechnic.purdue.edu/facilities/lobe
https://orcid.org/0000-0003-0695-3868
https://scholar.google.com/citations?user=Gie0Q30AAAAJ&hl=en

RESEARCH INTERESTS

- Organic (polymer), biocompatible, physically flexible electronics
- Neuromorphic / Embodied AI architecture and memristive systems
- Biomedical applications / health care electronics (bio-electronic medicine)
- Meta-, adaptive, and functional materials for soft and flexible robotics

EDUCATION AND RESEARCH

Purdue University, School of Engineering Technology, West Lafayette, IN, USA **2025 –**
Associate Professor

POSTECH, Materials Science and Engineering, Pohang, South Korea **2026 – 2026**
Visiting Scholar

Italian Institute of Technology, Event-Driven Perception for Robotics, Genova, Italy **2025 – 2026**
Visiting Researcher

Purdue University, School of Engineering Technology, West Lafayette, IN, USA **2017 – 2025**
Assistant Professor

The University of Tokyo, Tokyo, Japan **2015 – 2017**
Japanese Society for the Promotion of Science (JSPS) Postdoctoral Research Fellow
Project: "Ultra-thin and flexible neuromorphic organic e-skin for bioelectronics"
Supervisor: Prof. **Takao Someya**

University of Nova Gorica, Nova Gorica, Slovenia **2014 – 2015**
Postdoctoral Research Associate
Project: "Carrier mobilities in blends of organic semiconductors and graphene"
Supervisor: Prof. **Gvido Bratina**

University of Colorado, Boulder, CO, USA **2013 – 2014**
Postdoctoral Research Associate
Project: "Carrier mobilities in organic semiconductors and liquid crystals"
Supervisor: Prof. **Sean Shaheen**

University of Denver, Denver, CO, USA **2011 – 2013**
PhD in Engineering
Dissertation: "Fabrication and Application of A Polymer Neuromorphic Circuitry

Based on Polymer Memristive Devices and Polymer Transistors"
Supervisor: Prof. **Richard Voyles** and Prof. **Sean Shaheen**

Swiss Federal Institute of Technology (ETH), Zürich, Switzerland **2010 – 2011**
Graduate Research Internship
Research Topic: "Wireless Electrical Power to Sub-millimeter Robots"
Supervisor: Prof. **Bradley Nelson**

University of Denver, Denver, CO, USA **2008 – 2011**
M.S. in Computer Engineering
Thesis: "Simulation, Application, and Resilience of An Organic Neuromorphic Architecture, Made with Organic Memristors and Organic Field Effect Transistors"
Supervisor: Prof. **Richard Voyles** and Prof. **Sean Shaheen**

New Jersey Institute of Technology, Newark, NJ, USA **2001 – 2004**
B.S. in Computer Engineering
Areas of Concentration: Computer Communication
Supervisor: Prof. **Roberto Rojas-Cessa**

Union Country College, Cranford, NJ, USA **1998 – 2001**
A.S. in Engineering
Areas of Concentration: Computer Engineering

WORK EXPERIENCE

University of Denver, Denver, CO, USA **2009 – 2013**
Graduate Teaching Assistant / Graduate Research Assistant
Research: OLEDs and eInk (electronic displays), water hammer (robotic propulsion), dielectrophoresis (improvement of mobility in organic semiconductors)

Comcast Corporation, Greenwood Village, CO, USA **2006 – 2009**
TRAC Technician

Turner Engineering, Mountain Lakes, NJ, USA **2004 – 2006**
Network Engineer, Systems Engineer, IT

United States Postal Service, Jersey City, NJ, USA **1997 – 2004**
Distribution Clerk

RESEARCH FUNDING

External Grants ($1.3M of $2.4M)

Collins Aerospace ($250k)	**2023 – 2026**
National Institute of Food & Agriculture (2023-67021-41369; $240k of $591k)	**2023 – 2026**
Office of Naval Research (N00014-21-1-2585; $509k)	**2021 – 2025**
Showalter Research Trust ($56 of $75k)	**2021 – 2022**
Showalter Research Trust ($31 of $75k)	**2021 – 2022**
Scheme of Promotion of Academic and Research Collaboration ($140k)	**2019 – 2020**

National Institute of Food & Agriculture (2018-67007-28439; $20k of $540k)	**2018 – 2024**
RoSeHUB (17000570; $55k)	**2018 – 2018**
Japan Society for the Promotion of Science (P15062; $85k)	**2015 – 2017**
National Science Foundation Scholarship (1053249; $27k)	**2010 – 2011**

Internal Grants ($328k of $711k)

Purdue University – Ross Lynn Postdoctoral Fellowship ($25k)	**2023 – 2024**
Purdue Research Foundation – Bilsland Dissertation Fellowship ($32k)	**2022 – 2023**
Honors College of Purdue University – Workshop ($1k)	**2020**
Laboratory and University Core Facility Research Equipment ($65k)	**2020**
Purdue Research Foundation – Doctoral Fellowship ($31k)	**2022 – 2023**
Laboratory and University Core Facility Research Equipment ($88k of $150k)	**2019**
Laboratory and University Core Facility Research Equipment ($6.5k of $170k)	**2019**
Laboratory and University Core Facility Research Equipment ($48k of $65k)	**2019**
Purdue Institute for Integrative Neuroscience ($20k of $150k)	**2019**
Purdue Polytechnic Institute Equipment Seed Grant ($8k)	**2019**
Purdue Polytechnic Institute Equipment Seed Grant ($2.5k of $11k)	**2019**
Purdue Polytechnic Institute Seed Grant ($1k of $3.3k)	**2019**

AWARDS AND HONORS

Office of Naval Research, Young Investigator	**2021**
Ralph W. and Grace M. Showalter Research Trust	**2021, 2021**
Japanese Society for the Promotion of Science, Postdoctoral Fellow	**2015**
Habilitation from University of Nova Gorica	**2014**
University of Denver Fellowship	**2012, 2013**
University of Denver Best Teaching Assistant Award	**2012**
IEEE Safety Security and Rescue Robotics Symposium Best Paper Award	**2011**
New Jersey Institute of Technology Summa Cum Laude Award	**2004**
Union County Alumni Prize	**2001**
Post-Day Memorial Award	**2001**

PUBLICATIONS

Yang, Y., Wang, R., Pippin, A., Chakola, R., Bartoch, N., **Nawrocki, R.A.**, *Minimalistic Neuromorphic Control of an EV*, **npj Flexible Electronics**, In preparation	**2026**
Hosseini, M.J.M., **Nawrocki, R.A.**, *Complimentary Organic Field Effect Transistors*, **Organic Electronics**, In preparation	**2026**
Fan, J., French, R.M., **Nawrocki, R.A.**, *Additively Manufactured Acoustic Guitar Pickup*, **The Journal of the Acoustical Society of America**, in preparation	**2026**

Fadayomi, O.M., Rao, D.M., Rane, S.S., Jiang, W., Bai, H., Fan, J., Ward, M.P., **Nawrocki, R.A.**, *Nanomesh PVdF sensor with inkjet printed PEDOT:PSS electrodes for monitoring bird health*, **Advanced Manufacturing**, under review **2026**

Huang, N.M., Fadayomi, O.M., Leon-Salas, W.D., Karcher, D., **Nawrocki, R.A.**, *Design Of Portable a Portable System for Keel Bone Damage Monitoring of Egg Laying Hens*, **IEEE Sensors**, under review **2026**

Fan, J., Xu, S., Harmon, D., Deng, Y., Newell, B., Wu, W., **Nawrocki, R.A.**, *Fully Additively Manufactured Soft Functional Materials With Fabrication-Embedded, Stretch-Induced Strain-Insensitive Pressure Sensors*, **Advanced Materials**, under review **2026**

Hosseini, M.J.M., Fatahi, M., Yang, Y., Faezipour, M., Indiveri, G., **Nawrocki, R.A.**, *An organic spiking artificial neuron with excitatory and inhibitory synapses: towards soft and flexible organic neuromorphic processing*, **npj Flexible Electronics**, doi: 10.1038/s41528-025-00512-6 **2026**

Bai, H., Yang, Y., Voyles, R.M., **Nawrocki, R.A.**, *Additively Manufactured Organic Field-Effect Transistors and Circuits with Bifunctional Molecular Engineering of Dielectric/Semiconductor Interface*, **Organic Electronics**, doi: 10.1016/j.orgel.2026.107381 **2026**

Vyshniakova, K., Hosseini, M.J.M., Bai, H., Rocha Malacco, V.M., Voyles, R.M., Donkin, S.S., **Nawrocki, R.A.**, *Aqueous Ammonia Sensor with Neuromorphic Detection*, **Advanced Electronic Materials**, doi: 10.1002/aelm.202400509 **2025**

Fan, J., Xu, S., Newell, B., Garcia Bravo, J.M., Wu, R.M., **Nawrocki, R.A.**, *Liquid-based Material Extrusion of Flexible Silver Electrodes onto Electrospun Poly(vinylidene fluoride) Microfibers for Soft Piezoelectric Pressure Sensors: Towards Fully Three-dimensional Printed Functional Materials*, **Nano Energy**, doi: 10.1016/j.nanoen.2025.110820 **2025**

Yang, Y., Voyles, R.M., Zhang, H.H., **Nawrocki, R.A.**, *Fractional-order spike timing dependent gradient descent for multi-layer spiking neural networks*, **Neurocomputing**, doi: 10.1016/j.neucom.2024.128662 **2024**

Bai, H., Voyles, R.M., **Nawrocki, R.A.**, *Inkjet Printing of a Gate Insulator: Towards Fully Printable Organic Field Effect Transistor*, **electronic materials**, doi: 10.3390/electronicmat5030011 **2024**

Hosseini, M.J.M., Yang, Y., Kruger, W., Yokota, T., Lee, S., Someya, T., **Nawrocki, R.A.**, *270 nm, ultra-thin, self-adhesive, and conformable, long-term air-stable organic electronics bio-signal amplifier*, **npj Flexible Electronics**, doi: 10.1038/s41528-023-00267-y **2023**

Yang, Y., Bartolozzi, C., Zhang, H.H., **Nawrocki, R.A.**, *Neuromorphic Electronics for Robotics Perception, Navigation and Control: A Survey*, **IEEE Transactions on Robotics**, doi: 10.1016/j.engappai.2023.106838 **2023**

Simons, K., Vyshniakova, K., **Nawrocki, R.A.**, El-Shahat, A., Newell, B., *The Effects of Electroplating on the Mechanical Properties of Additively Manufactured Structures*, **ASME 2023 Conference on Smart Materials, Adaptive Structures and Intelligent Systems** (SMASIS), doi: 10.1115/SMASIS2023-110933 **2023**

Kaur, U., Malacco, V.M.R., Bai, H., Price, T.P., Datta, A., Xin, L., Sen, S., **Nawrocki, R.A.**, Chiu, G., Sundaram, S. Min, B.C., Daniels, K.M., White, R.R., Donkin, S.S., Brito, L.F., Voyles, R.M., *Invited Review: Integration of Technologies and Systems for Precision Animal Agriculture–A Case Study on Precision Dairy Farming*, **Journal of Animal Science**, doi: 10.1093/jas/skad206 **2023**

Hosseini, M.J.M., Yang, Y., Prendergast, A.J., Donati, E., Faezipour, M., Indiveri, G., **Nawrocki, R.A.**, *An organic synaptic circuit: toward flexible and biocompatible organic neuromorphic processing*, **Neuromorphic Computing and Engineering**, doi: 10.1088/2634-4386/ac830c **2022**

Prendergast, A.J., Hosseini, M.J.M., **Nawrocki, R.A.**, Faezipour, M., *Real-Time Generation of Hyperbolic Neuronal Spiking Patterns*, **44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society** (EMBC), doi: 10.1109/EMBC48229.2022.9870915 **2022**

Bai, H., Yang, Y., Voyles, R.M., **Nawrocki, R.A.**, *A no-hysteresis TIPS–pentacene:polystyrene blend-based organic field effect transistor by extruded direct ink writing and the application in a resistive load inverter circuit*, **Journal of Materials Chemistry C**, doi: 10.1039/D2TC00948J **2022**

Fan, J., Newell, B., Garcia, J., Voyles, R.M., **Nawrocki, R.A.**, *Effect of Additive Manufacturing on β-Phase Poly (Vinylidene Fluoride)-Based Capacitive Temperature Sensors*, **Advanced Engineering Materials**, doi: 10.1002/adem.202200485 **2022**

Fan, J., Deneke, N., Newell, B., Garcia, J., Davis, C., Voyles, R.M., **Nawrocki, R.A.**, *Electric Poling-assisted Additive Manufacturing Technique for Piezoelectric Active Poly(vinylidene fluoride) Films: Towards Fully 3D Printed Functional Materials Functional Materials*, **Additive Manufacturing**, doi: 10.1016/j.addma.2022.103248 **2022**

Yang, Y., Hosseini, M.J.M., Kruger, W., **Nawrocki, R.A.**, *Modular Modeling of Organic Neuromorphic Circuits: Towards Prototyping of Hardware-Level Spiking Neural Networks*, **IEEE Journal of Solid-State Circuits**, doi: 10.1109/TCSI.2022.3226163 **2022**

Hosseini, M.J.M., Donati, E., Indiveri, G., **Nawrocki, R.A.**, *Organic Log-Domain Integrator Synapse*, **Advanced Electronic Materials**, doi: 10.1002/aelm.202100724 **2022**

Han, C.S., Kaur, U., Bai, H., Roqueto dos Reis, B., White, R., **Nawrocki, R.A.**, Voyles, R.M., Kang, M.G., Priya, S., *Invited review: Sensor technologies for real-time monitoring of the rumen environment*, **Journal of Dairy Science**, doi: 10.3168/jds.2021-20576 **2022**

Gonzalez, D., Garcia, J., Voyles, R.M., **Nawrocki, R.A.**, Newell, B., *Characterization of 3D printed pneumatic soft actuator*, **Sensors and Actuators A: Physical**, doi: 10.1016/j.sna.2021.113337 **2022**

Fan, J., Newell, B., Garcia, J., Voyles, R.M., **Nawrocki, R.A.**, *Contact-Poling Enhanced, Fully 3D Printed PVdF Pressure Sensors: Towards 3D Printed Functional Materials*, **ASME 2021 Conference on Smart Materials, Adaptive Structures and Intelligent Systems** (SMASIS), doi: 10.1115/SMASIS2021-67832 **2021**

Yang, Y., Bai, H., **Nawrocki, R.A.**, Voyles, R.M., Zhang, H.H., *Fractional Drift-Diffusion Model of Organic Field Effect Transistors Including Effects of Bending Stress for Smart Materials*, **ASME 2021 Conference on Smart Materials, Adaptive Structures and Intelligent Systems** (SMASIS), doi: 10.1115/SMASIS2021-68344 **2021**

Vyshniakova, K., Bai, H., Rocha Malacco, V.M., Pavlica, E., Voyles, R.M., Donkin, S.S., Gehman, A., **Nawrocki, R.A.**, *Electrochemical ZnO-Based Sensor for Aqueous Ammonia Detection for Precision Animal Agriculture*, **ElectroChemical Society** (ECS), doi: 10.1149/MA2021-01571541mtgabs **2021**

Bai, H., Vyshniakova, K., Pavlica, E., Rocha Malacco, V.M., Yiannikouris, A., Yerramreddy, T., Voyles, R.M., Donkin, S.S., **Nawrocki, R.A.**, *Impedimetric Detection of Histamine Using PEDOT:PSS-Based Organic Electrochemical Sensor for Precision Animal Agriculture*, **ElectroChemical Society** (ECS), doi: 10.1149/MA2021-01321047mtgabs **2021**

Hosseini, M.J.M., **Nawrocki, R.A.,** *A Review of the Progress of Thin-Film Transistors and Their Technologies for Flexible Electronics.* **Micromachines**, doi: 10.3390/mi12060655 **2021**

Yang, Y., **Nawrocki, R.A.,** Voyles, R.M., Zhang, H.H., *A Fractional Drift Diffusion Model for Organic Semiconductor Devices.* **CMC-Computers Materials & Continua**, doi: 10.32604/cmc.2021.017439 **2021**

Bai, H., Vyshniakova, K., Pavlica, E., Rocha Malacco, V.M., Yiannikouris, A., Yerramreddy, T.R., Donkin, S.S., Voyles, R.M., **Nawrocki, R.A.,** *Impedimetric, PEDOT:PSS-based Organic ElectroChemical Sensor for Detection of Histamine* **2020**

for Precision Animal Agriculture. **IEEE Sensors Letters**, doi: 10.1109/LSENS.2020.3025162

Hosseini, M.J.M., Donati, E., Yokota, T., Lee, S., Indiveri, G., Someya, T., **Nawrocki, R.A.,** *Organic Electronics Axon-Hillock Neuromorphic Circuit: Towards Biologically Compatible, And Physically Flexible Integrate-And-Fire Spiking Neural Networks.* **Journal of Physics D: Applied Physics**, doi: 10.1088/1361-6463/abc585 **2020**

Delbruck, T., et al., **Nawrocki, R.A.,** Leon-Salas, W.D., *Lessons Learned the Hard Way.* **Proceedings of The IEEE International Symposium on Circuits and Systems** (ISCAS), doi: 10.1109/ISCAS45731.2020.9180983 **2020**

Mamer, T., Garcia, J., Leon-Salas, W.D., Voyles, R., **Nawrocki, R.A.,** Yokota, T., Someya, T., Ducharne, B., Newell, B., *Production of 3D Printed Flexible Strain Sensors.* **The ASME 2020 Conference on Smart Materials, Adaptive Structures and Intelligent Systems** (SMASIS), doi: 10.1115/SMASIS2020-2235 **2020**

Rodriguez, D.G., Garcia, J., Ducharne, B., Voyles, R., **Nawrocki, R.A.,** Newell, B., *3D Printing of Flexible Sensing Actuators.* **The ASME 2020 Conference on Smart Materials, Adaptive Structures and Intelligent Systems** (SMASIS), doi: 10.1115/SMASIS2020-2239 **2020**

Fan, J., Gonzalez, D.F., Garcia-Bravo, J., Newell, B., **Nawrocki, R.A.,** *The effects of additive manufacturing and poling techniques on PVdF thin films: Towards 3D printed functional materials.* **The ASME 2020 Conference on Smart Materials, Adaptive Structures and Intelligent Systems** (SMASIS), doi: 10.1115/SMASIS2020-2245 **2020**

Yang, Y., **Nawrocki, R.A.,** Voyles, R.M., Zhang, H.H., *Modeling of an Internal Stress and Strain Distribution of an Inverted Staggered Thin-Film Transistor Based on Two-Dimensional Mass-Spring-Damper Structure.* **Computer Modeling in Engineering & Science**, doi: 10.32604/cmes.2020.010165 **2020**

Yang, Y., **Nawrocki, R.A.,** Voyles, R.M., Zhang, H.H., *Modeling of the Electrical Characteristics of an Organic Field Effect Thin-Film Transistor in Presence of the Bending Effects.* **Organic Electronics**, doi: 10.1016/j.orgel.2020.106000 **2020**

Nawrocki, R.A., *Super- and Ultrathin Organic Field-Effect Transistors: from Flexibility to Super- and Ultraflexibility*, **Advanced Functional Materials**, doi: 10.1002/adfm.201906908 **2019**

Pavlica, E., Pastukhova, N., **Nawrocki, R.A.**, Ciesielski, A., Tkachuk, V., Samori, P., Bratina, G., *Enhancement of Charge Transport in Polythiophene Semiconducting Polymer by Blending with Graphene Nanoparticles*, **Chem Plus Chem**, doi: 10.1002/cplu.201900219 **2019**

Ayad, M., Aghamohammadi, N.R., **Nawrocki, R.A.**, Voyles, R.M., Kusuma, D., *Designer Polymers: Additive Manufacturing of Smart Materials as a Complement to Injection Molding*, **SPE Annual Technical Conference and Exhibition**, SPE **2019**

Nawrocki, R.A., Hanbit, J., Lee, S., Yokota, T., Sekino, M., Someya, T., *Self-Adhesive and Ultra-Conformable Sub 300-nm Dry Thin-Film Electrodes for Surface Monitoring of Biopotentials*, **Advanced Functional Materials**, doi: 10.1002/adfm.201803279 **2018**

Zhang, H.H., **Nawrocki, R.A.**, Li, Q., *On Basics and Applications of Multidisciplinary Engineering and Technology Education*, **Contemporary Educational Research: Education and Human Rights**, ISBN-13: 978-613-9-93799-8 **2018**

Ayad, M., **Nawrocki, R.A.**, Voyles, R.M., Lee, J., Lee, H., Leon-Salas, W.D., *Nucleos: Toward Rapid-Prototyping of Robotic Materials That Can Sense, Think And Act*, **The ASME 2018 Conference on Smart Materials, Adaptive Structures and Intelligent Systems** (SMASIS) 2018-8245, doi:10.1115/SMASIS2018-8245 **2018**

Balakuntala, M.V., Ayad, M., Voyles, R.M., White, R., **Nawrocki, R.A.**, Sundaram, S., Priya, S., Chiu, G., Donkin, S., Min, B-C., Daniels, K., *Global Sustainability Through Closed-Loop Precision Animal Agriculture*, **Mechanical Engineering Magazine,** doi: 10.1115/1.2018-Jun-7 **2018**

Sheregar, D., Hung, V., Walker, J., Hoilett, O., Linnes, J., **Nawrocki, R.A.**, *Thin Film Cocaine Sensors*, **The Summer Undergraduate Research Fellowship (SURF) Symposium**, https://docs.lib.purdue.edu/surf/2018/Presentations/130/ **2018**

Nawrocki, R.A., Voyles, R.M., Shaheen, S.E., *A Mini-Review of Neuromorphic Architectures and Implementations*, **IEEE Transactions on Electron Devices**, doi: 10.1109/ted.2016.2598413 **2016**

Lee, S., Reuveny, A., Matsuhisa, N., **Nawrocki, R.A.**, N., Yokota, T., Someya, T., *Enhancement of Closed-Loop Gain of Organic Amplifiers Using Double Gate Structures*, **IEEE Electron Device Letters**, doi: 10.1109/led.2016.2554159 **2016**

Nawrocki, R.A., Matsuhisa, N., Yokota, T., Someya, T., *300-nm Imperceptible, Ultraflexible, and Biocompatible e-Skin Fit with Tactile Sensors and Organic Transistors*, **Advanced Electronic Materials**, doi: 10.1002/aelm.201500452 **2016**

Nawrocki, R.A., Pavlica, E., Ćelić, N., Orlov, D., Mihailović, D., Bratina, G., *Fabrication of Poly(3-hexylthiophene) Nanowires for High-Mobility Transistors*, **Organic Electronics**, doi: 10.1016/j.orgel.2015.11.038 **2016**

Nawrocki, R.A., Voyles, R.M., Shaheen, S.E., *Neurons in Polymer: Hardware Neural Unites based on Polymer Memristive Devices and Transistors*, **IEEE Transactions on Electron Devices**, doi: 10.1109/ted.2014.2346700 **2014**

Nawrocki, R.A., Galiger, E.M., Bailey, B.A., Ostrowski, D., Jiang, X., Voyles, R.M., Kopidakis, N., Olson, D.C., Shaheen, S.E., *An Inverted, Organic WORM Device Based on PEDOT:PSS with Very Low Turn-On Voltage*, **Organic Electronics**, doi: 10.1016/j.orgel.2014.05.003 **2014**

Nawrocki, R.A., *Fabrication And Application of A Polymer Neuromorphic Circuitry Based on Polymer Memristive Devices and Polymer Transistors*, Doctor of Philosophy, University of Denver **2014**

Cui, Y., Voyles, R.M., **Nawrocki, R.A.**, Jiang, G., *The Morphing Bus: A New Paradigm in Peripheral Interconnect Bus*, **IEEE Transactions on Components, Packaging and Manufacturing Technology**, doi: 10.1109/tcpmt.2013.2273663 **2013**

Nawrocki, R.A., Voyles, R.M., Shaheen, S.E., *Polymer and Nanoparticle-Composite Bistable Devices: Physics of Operation and Initial Applications*, **Advances in Neuromorphic Memristor Science and Applications**, doi: 10.1007/978-94-007-4491-2_15 **2012**

Nawrocki, R.A., Shalaan, M., Shaheen, S. E., Lorenzon, N.M., *Monitoring Performance Degradation of Cerebellar Functions Using Computational Neuroscience Methods: Implications on Neurological Diseases*, **Public Library of Science**, doi: 10.1371/journal.pone.0045581 **2012**

Nawrocki, R.A., Frutiger, D. R., Voyles, R.M., Nelson, B. J., *Wireless Electrical Power to Sub-millimeter Robots*, **IEEE International Conference on Intelligent Robotics and Automation**, doi: 10.1007/978-3-642-33515-0_31 **2012**

Nawrocki, R.A., *Simulation, Application, And Resilience of An Organic Neuromorphic Architecture, Made With Organic Bistable Devices And Organic Field Effect Transistors*, Master of Science, University of Denver **2011**

Nawrocki, R.A., Yang, X., Shaheen, S.E., Voyles, R.M., *Structured Computational Polymers for a Soft Robot: Actuation and Cognition*, **IEEE International Conference on Robotics and Automation**, doi: 10.1109/icra.2011.5980122 **2011**

Nawrocki, R.A., Shaheen, S.E., Voyles, R.M., *A Neuromorphic Architecture from Single Transistor Neurons With Organic Bistable Devices for Weights*, **IEEE International Joint Conference on Neural Networks**, doi: 10.1109/ijcnn.2011.6033256 **2011**

Nawrocki, R.A., Voyles, R.M., *Artificial Neural Network Performance Degradation Under Network Damage: Stuck-At Faults*, **IEEE International Joint Conference on Neural Networks**, doi: 10.1109/ijcnn.2011.6033255 **2011**

Nawrocki, R.A., Voyles, R.M., Shaheen, S.E., *Structured Computational Polymers for Safety, Security, and Rescue Robotics*, **IEEE International Symposium on Safety, Security and Rescue Robots**, doi: 10.1109/ssrr.2011.6106800 **2011**

Benureau, F., Das, G.P, Kompella, V., **Nawrocki, R.A.**, Baldassarre, G., Nguyen, S.M., Mirolli, M, Sperati, V, Mannella, F, Fiore, V, Caligiore, D, Santucci, V, *Intrinsic Motivations for Forming Actions and Producing Goal Directed Behaviour*, **Capo Caccia Neuromorphic Workshop**, ResearchGate **2011**

Nawrocki, R.A., Voyles, R.M., Shalaan, M., *Monitoring Artificial Neural Network Performance Degradation Under Network Damage*, **Artificial Neural Networks In Engineering**, doi: 10.1115/1.859599.paper13 **2010**

Nawrocki, R.A., Shaheen, S.E., Yang, X., Voyles, R.M., *Towards an All-Polymer Robot for Search and Rescue*, **IEEE International Symposium on Safety, Security and Rescue Robotics**, doi: 10.1109/ssrr.2009.5424154 **2009**

Nawrocki, R.A., Abisaleh, D., Rojas-Cessa, R., *Implementation of Scheduling Algorithms for Input-Queued Packet Switches: an Undergraduate Senior Project Experience*, Proceedings of the X Workshop, **Iberchip** **2004**

PATENTS

Filed

Customizable Pickup Sensor System and Method; PRF No.: 70665-01; Appl. No.: 63/798,905 **2025**

Ultra Low Voltage, Flexible And Biocompatible Complimentary Organic Transistors With Single Substrate Integrated Capacitors; PRF No.: 70317; Appl. No.: 63/821,954 **2025**

Excitatory And Inhibitory Pulsed Current-Source Synaptic Circuits Operating With Axon-Hillock Circuits; PRF No.: 70318; Appl. No.: 63/821,960 **2025**

Method Of Making Piezoelectric Sensors And Piezoelectric Sensors Made Therefrom; PRF No.: 70070-01; Appl. No.: 18/889,005 **2023**

Method Of Making Stretchable Sensors And Sensors Made Therefrom; PRF No.: 70070-02; Appl. No.: 18/889,014 **2023**

Awarded

Method of making flexible transducers; US2025/0092575 A1; Appl. No: US18/889,005 **2025**

Flexible transducer; US2025/0098543 A1; Appl. No: US18/889,014 **2025**

Capacitive sensors and methods and apparatuses for producing capacitive sensors; US2023/0405920 A1; Appl. No: US18/336,191 **2023**

Piezoelectric sensors and methods and apparatuses for producing piezoelectric sensors; US2023/0405931 A1; Appl. No: US18/336,567 **2023**

INVITED TALKS

Organic Neuromorphic Platforms for Soft Robotics, **International Thin-Film Transistor Conference (ITC)** **2026**

Soft Computing with Soft Materials: Organic Spiking Neuromorphic Circuits, **Workshop on Neuromorphic Organic Devices** **2025**

Organic Spiking Neuromorphic Circuits: Flexible Embodied AI, **19th US-Korea Forum on Nanotechnology (part of Nano Korea 2025)** **2025**

Organic Electronics: Smart Structures and Neuromorphic Computing, **Purdue – DGIST visit** **2024**

Organic Electronics: Smart Structures and Neuromorphic Computing, **Purdue – Hiroshima University visit** **2024**

Additive Manufacturing of Soft Materials and Devices, **3rd Workshop on Neuromorphic Organic Devices** **2023**

Towards Flexible, Printable Neuromorphic Perception for Soft Robotics, **Neuromorphic Haptics - Transitioning From Touch Sensors to Perception** **2023**

Soft Computing with Soft Materials, **2nd Workshop on Neuromorphic Organic Devices** **2022**

Soft Spiking Synaptic Circuits for Neural Interfaces, **Materials Research Society (MRS)** **2022**

Spiking Organic Electronics Synaptic Circuits, **Materials Research Society (MRS)** **2021**

Organic Electronics Axon-Hillock Neuron: Towards Flexible and Biocompatible Network of Spiking Neurons, **European Materials Research Society (E-MRS)** **2021**

Super-thin Organic Smart Electronics Skin, **International Conference on Modern Materials & Technologies (CIMTEC)** **2021**

Physically Flexible and Biological Compatible Demonstration of an Organic Electronics Axon-Hillock Neural Circuit, **Materials Research Society (MRS)** **2020**

Organic electronic Axon-Hillock neural circuit: towards biologically compatible, and physically flexible Integrate-and-Fire spiking neural networks, **European Materials Research Society (E-MRS)** **2020**

Polymer Neuromorphic Circuitry Based On Polymer Memristive Devices and Polymer Transistors: Design, Fabrication, and Application, **1st Workshop on Organic Neuromorphic Devices** **2019**

Organic BioElectronic Neural Interfaces, **Purdue Honors College "How we Think: We're Already Cyborgs"** **2019**

Organic Bio-Electronics: Health Care and Soft Robotics, **Central Indiana Section IEEE Engineering Conference (CIS-IEEE)** **2017**

300 nm imperceptible organic electronics: technology and the future of medical applications, **Emerging Technologies; Communications, Microsystems, Optoelectronics, Sensors (ETCMOS)** **2017**

Organic bio-electronics for health care applications, **Japanese Society for the Promotion of Science (JSPS): Science Dialog** **2017**

Ultra-thin, ultra-flexible, ultra-conformable electronics for healthcare, biomedical applications, **European Materials Research Society (E-MRS)** **2016**

Organic electronics artificial e-skin for human, prosthetic, and robotic application, **Japanese Society for the Promotion of Science (JSPS): Science Dialog** **2016**

Memristive Synapses for Neuromorphic Systems, **Capo Caccia Cognitive Neuromorphic Engineering Workshop** **2011**

CONFERENCES AND PRESENTATIONS

Additively Manufactured Functional Materials with Embedded Sensing and Actuation, **European Materials Research Society (E-MRS)** **2025**

Form+Function 4D Printing: Printed Organic Field Effect Transistors, **Materials Research Society (MRS)** **2023**

Simulation of Organic Field Effect Transistor In Presence of Stress/Strain Effects, **Materials Research Society (MRS)** **2022**

Electrochemical ZnO-Based Sensor for Aqueous Ammonia Detection for Precision Animal Agriculture, **ElectroChemical Society (ECS)** **2021**

Impedimetric Detection of Histamine Using PEDOT:PSS-Based Organic Electrochemical Sensor for Precision Animal Agriculture, **ElectroChemical Society (ECS)** **2021**

Flexible Thin-Film Sensor for Electrochemical Detection of Cocaine, **Biomedical Engineering Society (BMES)** **2020**

Organic ElectroChemical Transistor-based Impedimetric Histamine Sensor, **International Meeting on Chemical Sensors (IMCS)** **2020**

The effects of additive manufacturing and poling techniques on PVdF thin films: Towards 3D printed functional materials, **The ASME 2020 Conference on Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS)** **2020**

3D Printed of Flexible Sensing Actuators, **The ASME 2020 Conference on Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS)** **2020**

Production of 3D Printed Flexible Strain Sensors, **The ASME 2020 Conference on Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS)** **2020**

Confession Session: Lessons Learned the Hard Way, **The IEEE International Symposium on Circuits and Systems (ISCAS)** **2020**

Polymer Neuromorphic Circuit Based on Polymer Memristive Devices and Polymer Transistors, **The 1st Workshop on Neuromorphic Organic Devices** **2019**

Motion Artifact Free Monitoring of Biopotentials, **International Winterschool on Bioelectronics Conference (BioEl)** **2019**

Sub-300 nm, self-adhesive and ultra-conformable dry thin-film electrodes for motion artifact-less monitoring of surface biopotentials, **Materials Research Society (MRS)** **2018**

Motion Artifact Free Monitoring of EMG/ECG Biopotentials Using Sub-300 nm Self-Adhesive and Ultra-Conformable Au/Parylene Thin-Film Electrodes, **International Mechanical Engineering Congress & Exposition (IMECE)** **2018**

NUCLEOS: Toward Rapid-Prototyping of Robotic Materials That Can Sense, Think and Act, **American Society of Mechanical Engineers Conference on Smart Materials, Adaptive Structures and Intelligent Systems (ASME-SMASIS)** **2018**

300-nm High Gain Multi-Stage Organic CMOS Inverters, **Solid State Devices and Materials (SSDM)** **2016**

300-nm and ultra-flexible, skin-compatible organic transistors, pseudo-CMOS and CMOS amplifiers for artificial skin in medical applications, **Materials Research Society (MRS)** **2016**

300-nm Highly Conformable Organic Thin Film Transistor, **International Thin-Film Transistor Conference (ITC)** **2016**

Time-of-flight photoconductivity in polymer/graphene blends, **American Physical Society (APS)** **2015**

Organic Field Effect Transistors: Device Architectures and Fabrication, **Organic Electronics Lecture at University of Colorado in Boulder** **2014**

Polymer Neuromorphic Circuitry: Biological Information Processing in Polymers, **Graduate Research Symposium at University of Denver** **2013**

Polymer Electronics for Low Power Conformable Displays, **Safety, Security and Rescue Robotics Workshop** **2012**

Organic Electronics, **Industry Day at University of Denver** **2012**

Towards an All-Polymer Robot for Search and Rescue, **Safety, Security and Rescue Robotics Workshop (SSRRC)** **2009**

POSTERS

MacWilliams, C., Siegmund, T., Karcher, D., **Nawrocki, R. A.**, *Using computational mechanics to model keel bone injury in laying hens*, **Purdue Ag-Engineering Symposium** **2025**

Warren, D.J., Hosseini, M.J.M, **Nawrocki, R.A.**, *Organic Electronics in the Axon-Hillock Circuit*, **The Summer Undergraduate Research Fellowship (SURF) Symposium** **2019**

300-nm organic transistors and sensors for surface biopotential monitoring, **Mi-Bio Summit on Flexible and Stretchable Bioelectronics** **2019**

Thin Film Opioid Sensors, (Sheregar, D.) **Summer Undergraduate Research Fellowship at Purdue University** **2018**

300-nm ultra-flexible and skin-compatible organic transistors for e-skin, **Symposium on Supramolecular Chemistry and Functional Materials** **2016**

Organic Semiconductors for Space Flight Applications, AeroSpace Ventures Day at **University of Colorado in Boulder** **2014**

PaperBots – Rapid Prototyping of Inexpensive Robots" and "Structured Computational Polymers, Undergraduate Outreach at **Purdue University** **2013**

Deposition of Organic Photovoltaic Thin Films via Blade-coating, Undergraduate Outreach at **University of Denver** **2012**

Monitoring Performance Degradation of Cerebellar Functions Using Computational Neuroscientific Methods, **Front Range Neuroscience Group** **2009**

The time evolution of entropy during the training of neural networks, **Front Range Neuroscience Group** **2008**

REVIEWED JOURNALS & CONFERENCES

AAAS: Science Advances
ASME: Journal of Medical Devices; Artificial Neural Networks In Engineering
Elsevier: Journal of Microelectronics; Thin Solid Films; Nano Energy

Frontiers in: Frontiers in Nanotechnology
IEEE: Transactions on Neural Networks; Transactions on Electron Devices; Transactions on Emerging Topics in Computing, International Conference on Robotics and Automation; International Conference on Safety, Search and Rescue Robotics
MIT Press: Neural Computing
MPL: Nature Communications, Nature Electronics, npj Flexible Electronics, npj Robotics
Royal Society of Chemistry: Materials Advances
Science: Science Advances
USNAS: Proceedings of the National Academy of Sciences
Wiley: Advanced Materials; Advanced Functional Materials; Advanced Electronic Materials; Advanced Materials Technologies; Advanced Science

SYNERGISTIC ACTIVITIES

Reviewer: Canada Foundation for Innovation (CFI)	**2025**
Reviewer: German Research Foundation (DFG)	**2025, 2023**
Reviewer: Dutch Research Council (NWO)	**2023**
Reviewer: National Science Foundation EPMD program	**2023**
Co-organizer: National Workshop on Human-like Robots	**2022**
Reviewer: Showalter Research Trust reviewer	**2022**
Session Chair: Materials Research Society Spring Meeting	**2022, 2021**
Guest Editor: Special Issue of Wiley Advanced Electronics Materials	**2021**
Guest Editor: Special Issue of MDPI micromachines	**2021**
Session Chair: European Materials Research Society Spring Meeting	**2021**
Session Chair: ElectroChemical Society Meeting	**2021**
Reviewer: National Science Foundation, Graduate Research Fellowship Program	**2020**
Review Editor: Frontiers In Nanotechnology: Nanodevices	**2019 –**
Associate Editor: IEEE International Conference on Robotics and Automation	**2018**
Invited Panelist: CIS-IEEE EnCON	**2017**
Assistant Editor: IEEE Safety Security and Rescue Robotics Workshop	**2009**

UNIVERSITY SERVICE ACTIVITIES

Senator: Purdue University	**2023 – 2025**
Member: Carbon-Neutral Purdue Committee	**2022 –**
Faculty Mentor	**2022 –**
Co-chair: Soft-Materials Lithography Nanofabrication Center	**2020 – 2021**
Attendee: Robotics & Mechatronics Undergraduate and Graduate Program	**2019 – 2022**
Member: College Graduate School Committee	**2018 –**
Member: Industrial Advisory Meetings	**2018 –**

TEACHING EXPERIENCE

Purdue University, West Lafayette, IN, USA **2018 –**
Instructor
Courses Taught: Data Acquisition and Systems Control, DC and Pulse Electronics

University of Nova Gorica, Nova Gorica, Slovenia **2014 – 2015**
Teaching Assistant
Courses Taught: Mathematical Physics II

University of Denver, Denver, CO, USA **2009 – 2012**
Graduate Teaching Assistant
Courses Taught: Electrical Circuits I & II, Engineering Concepts I, II & III, Digital Design, Engineering Applications, Engineering Analysis, Climate Science

New Jersey Institute of Technology, Newark, NJ, USA **2002**
Undergraduate Teaching Assistant
Courses Taught: Physics, Mathematics, Computers, Robotics, English, Chemistry, Electronics

SUPERVISED STUDENTS AND POSTDOCTORAL RESEARCHERS

Ali Haji Ebrahim Zargar **2025 –**
PhD *in Engineering at Italian Institute of Technology, University of Genova, Italy*
Integration of piezoelectric tactile sensors with flexible neuromorphic electronics

Fatemeh Mohammadzadeh **2025 –**
MS *in Engineering Technology at Purdue University*, USA
Development and characterization of piezoelectric transducers

Wenjie Jiang **2025 –**
Postdoctoral Researcher *at Purdue University*, USA
Vibrational analysis for piezoelectric energy harvesting

Dhyanvi Maulikbhai Rao **2024 –**
MS *in BioMedical Engineering at Purdue University*, USA
Development and characterization of piezoelectric transducers

Shruti Shailesh Rane **2024 –**
MS *in BioMedical Engineering at Purdue University*, USA
Development and characterization of piezoelectric transducers

Yuelin (Daniel) Deng **2023 – 2025**
PhD *in Engineering Technology at Purdue University*, USA
Piezoelectric energy harvesting

Masoome Fatahi **2023 –**
PhD *in Engineering Technology at Purdue University*, USA
Spiking Organic Electronics Neuromorphic Circuits

Hisham Elkhatib **2023 – 2024**

PhD *in Engineering Technology at Purdue University*, USA
Physics of Organic Electronics

Yi Yang **2021 – 2023**
Postdoctoral Researcher *at Purdue University*, USA
Modeling and simulation of Organic Field Effect Transistors and circuits

Artem Kryvobok **2021 – 2022**
PhD *in Engineering Technology at Purdue University*, USA
Memristive Organic Neuromorphic Electronic circuits and systems

Huiwen Bai **2019 – 2024**
PhD *in Engineering Technology at Purdue University*, USA
Organic electrochemical sensors and Organic Field Effect Transistors

Katia Vyshniakova **2018 –**
Research Scientist *at Purdue University*, USA
Organic ElectroChemical Transistor-based chemical sensor and graphene synthesis

Mohammad Javad Mirshojaeian Hosseini **2018 – 2024**
PhD *in Engineering Technology at Purdue University*, USA
Organic Neuromorphic Electronic circuits and systems

Jinsheng Fan **2018 – 2023**
PhD *in Engineering Technology at Purdue University*, USA
Organic electronics 3D metamaterial

Datta Sheregar **2018 – 2021**
BS and MS in Engineering Technology at Purdue University, USA
Opioid sensor; 3D printing of electronics; co-advised with prof. *Richard Voyles*

Naveed Reza Aghamohammadi **2019 – 2021**
PhD *in Engineering Technology at Purdue University*, USA
4D printing of structures and electronics; co-advised with prof. *Richard Voyles*

Megan Baker **2019 – 2021**
MS *in Biomedical Engineering at Purdue University*, USA
Organic electrochemical sensors; co-advised with prof. *Krishna Jayant*

Moshan Guo **2019 – 2020**
Exchange student *from Tsinghua University*, Beijing, China
4D printing of structures and electronics; co-advised with prof. *Richard Voyles*

Egon Pavlica **2018 – 2019**

Postdoctoral Researcher *at Purdue University*, USA
Organic Electro-Chemical Transistor-based chemical sensor

Shih Hsuan (Vick) Hung **2018 – 2020**
BS in Engineering Technology at Purdue University, USA
Organic electronic thin film transistor circuits

Saw Yan Naung **2018 – 2019**
BS in Mechanical Engineering at Purdue University, USA
Piezoelectric tactile organic e-skin

Charles A Witt **2018 – 2018**
BS in Engineering Technology at Purdue University, USA
sEMG and neural network circuit for prosthetic control

Joshua Bell **2018 – 2018**
BS in Engineering Technology at Purdue University, USA
Inductive coupling for power and data transmission for electronic skin applications

Marissa Landa **2018 – 2018**
BS in Engineering Technology at Purdue University, USA
Piezoelectric tactile sensor and OFET active matrix electronic skin

Sunghoon Lee **2016 – 2017**
PhD in Engineering at the University of Tokyo, Japan
Surface treatment and device architecture of organic electronic amplifiers

Anže Peternel **2015 – 2015**
BS in Physics at University of Nova Gorica, Slovenia
Surface treatments methodologies (such as Self-Assembling Monolayers) for organic semiconductors and their effects on carrier mobilites

Raveendra Babu Penumala **2014 – 2015**
PhD in Physics at University of Nova Gorica, Slovenia
Properties of charge carriers in organic semiconductors and their blends with graphene

Jinta Mathew **2014 – 2015**
PhD in Physics at University of Nova Gorica, Slovenia
Properties of organic semiconductors using AFM and SEM characterization

Eric Carlson **2014 – 2014**
PhD in Physics at University of Colorado in Boulder, CO, USA
Organic semiconductors and liquid crystals in OFET arrangement

Matthew Watwood **2014 – 2014**

MS in Computer Science at University of Denver, CO, USA
Analysis of performance of artificial neural network during training

Victor Palacios **2014 – 2014**
BS in Electrical Engineering at University of Colorado Boulder, CO, USA
Surface and film morphology of spin and blade coated organic semiconductors in OFET and OPV arrangement

Jade Irizarry-Swordy **2013 – 2013**
BS in Electrical Engineering at University of Denver, CO, USA
Bulk co-polymers, doped with fullerenes, with the aim of developing self-organizing organic memristive devices

Erin Galiger **2011 – 2013**
BS in Computer Engineering at University of Denver, CO, USA
AFM and thin film deposition of organic materials, with the goal of understanding how process conditions relate to film quality and device performance in organic photovoltaics and organic field effect transistors

Rachelle Cobb **2010 – 2011**
BS in Computer Engineering at Rose-Hulman, IN, USA
Fabrication and characterization of OLEDs, with the aim of encapsulating with standard polymeric materials

Ryan McDonald **2009 – 2009**
BS in Computer Engineering at University of Denver, CO, USA
Fabrication and characterization of OLEDs, with the aim of encapsulating with standard polymeric materials

VIDEO / MEDIA / MULTIMEDIA

"Purdue Polytechnic Newsroom" **Online Article** **2024**
(https://polytechnic.purdue.edu/newsroom/usda-grant-creates-rare-three-college-collaboration-between-polytechnic-agriculture)

"Purdue Institute for a Sustainable Future" **Online Article** **2024**
(https://x.com/PurdueISF/status/1750905244144275751)

"Discovery Park District" **Online Article** **2023**
(https://discoveryparkdistrict.com/purdue-researchers-combine-electric-poling-and-3d-printing-into-a-single-step/)

"Purdue Research Foundation" **Online Article** **2023**
(https://stories.prf.org/tag/robert-nawrocki/)

"Communications of the ACM" **Online Article** **2023**

(https://cacm.acm.org/news/272379-researchers-combine-electric-poling-3d-printing-into-single-step/fulltext?mobile=false)

" 3D Printing Center" **Online Article** **2023**
(https://3dprintingcenter.net/researchers-have-developed-a-3d-printing-method-to-produce-piezoelectric-parts/)

" 3PRINTR" **Online Article** **2023**
(https://www.3printr.com/purdue-researchers-combine-electric-poling-and-3d-printing-0161970/)

" AM Chronicle" **Online Article** **2023**
(https://www.amchronicle.com/news/purdue-researchers-combine-electric-poling-and-3d-printing-into-a-single-step/)

" MirageNews" **Online Article** **2023**
(https://www.miragenews.com/electric-poling-and-3d-printing-combined-in-987828/)

" Eurekalert" **Online Article** **2023**
(https://www.eurekalert.org/news-releases/986302)

"Purdue Polytechnic Newsroom" **Online Article** **2021**
(https://polytechnic.purdue.edu/newsroom/nawrocki-nervous-system-treatment-research-awarded-polytechnic-first-showalter-grant)

"Purdue Materials Engineering" **Online Article** **2021**
(https://engineering.purdue.edu/MSE/news/2021/bahr-nawrocki-flexible-electrode-showalter-grant)

"Purdue Polytechnic Newsroom" **Online Article** **2021**
(https://polytechnic.purdue.edu/newsroom/nawrocki-honored-2021-young-investigator-award?utm_campaign=newsroom&utm_medium=social-post&utm_source=facebook&utm_content=2021-summer-news&utm_link=nawrocki-honored-younginvestigatoraward)

“Laboratory of Organic Bio-Electronics; Overview” **YouTube** **2020**
(https://polytechnic.purdue.edu/sites/default/files/files/LOBE_research.mp4)

“Laboratory of Organic Matter Physics; Overview” **GoTV** **2015**
(https://www.youtube.com/watch?v=FaWFtJL63e0)

“Can liquids think?” (given by *Richard Voyles*) **TEDxDU** **2011**
(http://tedxtalks.ted.com/video/TEDxDU-Richard-Voyles-Can-liqui)

LANGUAGES

English – speak, read, and write fluently
Polish – native language
Japanese – speak and read very poorly
Italian – speak and read poorly
Slovenian – speak and read poorly
Russian – speak and read poorly

CERTIFICATE

Cisco Certified Network Associate (CCNA): Cisco ID CSCO11174973

MEMBERSHIPS

American Society of Mechanical Engineers (ASME)
Institute of Electrical and Electronics Engineering (IEEE)
Materials Research Society (MRS)