

Solomon Prince Teye-Lartey, Ph.D.

Biomedical engineer, educator and researcher: wearable sensing, machine learning for physiological signals, and project based teaching

sptlartey1911@gmail.com steylea-portfolio.netlify.app LinkedIn

Toledo, Ohio. Open to relocation anywhere in the United States.

Profile

Biomedical engineer and educator with seven years of university teaching across two institutions and two countries, from laboratory instruction at Kwame Nkrumah University of Science and Technology (KNUST) in Ghana to teaching a project based engineering course as instructor of record at the University of Toledo. Students in my classes build things that work: ECG monitors on breadboards, Arduino circuits, internet connected medical devices.

My research asks what a wearable can honestly claim about the person wearing it. I build the sensing hardware and firmware, and the signal processing and machine learning that turn physiological signals into measurement, with close attention to validation. My work has been funded through a Department of Defense CDMRP award and published as first author. Ph.D. in Biomedical Engineering conferred May 2026.

5

courses taught
at Toledo

16

students in my
first course as
instructor

152

clinicians in the
PREPARE study

84.5%

balanced
accuracy,
subject-level
validation

\$1.1M

DoD CDMRP
award for the
program

Education

Conferred May 2026 **Ph.D., Biomedical Engineering**

University of Toledo, Toledo, Ohio. Cumulative GPA 3.63 of 4.0.

- Dissertation: *Multimodal Physiological Assessment for Clinical Competency Classification: A Machine Learning Approach with Implications for Personalized Healthcare Training*
- Advisor: Scott M. Pappada, Ph.D. Committee members include Brent D. Cameron, Ph.D. (Chair, Bioengineering) and Shaza Aouthmany, M.D. (Emergency Medicine)

2013 to 2017

B.Sc., Biomedical Engineering

Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. First Class Honours, CWA 76 of 100.

- Focus: biomedical electronics, bioinstrumentation, bio-signal processing
- KNUST Excellent Student Award, 2015

Appointments

DATES	POSITION	INSTITUTION
Aug 2022 to May 2026	Graduate Research Assistant, Technology Development Laboratory	University of Toledo College of Medicine and Life Sciences
Spring 2022 (Jan to Jul)	Instructor of Record, BIOE 4980/5980 Medical Internet of Things	University of Toledo, Department of Bioengineering
Aug 2019 to Dec 2021	Graduate Teaching Assistant	University of Toledo, Department of Bioengineering
Aug 2017 to Jul 2018	Teaching Assistant	KNUST, Department of Biomedical Engineering, Ghana

Teaching

Courses taught

INSTITUTION	COURSE	ROLE	TERM
University of Toledo	BIOE 4980/5980 Medical Internet of Things (3 credit hours)	Instructor of record	Spring 2022
University of Toledo	Medical Internet of Things (first offering)	Graduate teaching assistant	2021
University of Toledo	Biomedical Instrumentation, with laboratory	Teaching assistant, laboratory lead	2019 to 2021
University of Toledo	Biomedical Signal Processing	Teaching assistant	2019 to 2021
University of Toledo	Biomedical Electronics	Teaching assistant	2019 to 2021
University of Toledo	Physiology for Bioengineers	Teaching assistant	2019 to 2021
KNUST, Ghana	Biomedical Electronics and Instrumentation	Teaching assistant	2017 to 2018
KNUST, Ghana	Medical Imaging	Teaching assistant	2017 to 2018
KNUST, Ghana	Biomedical Optics	Teaching assistant	2017 to 2018

INSTITUTION	COURSE	ROLE	TERM
KNUST, Ghana	Cell Biology	Teaching assistant	2017 to 2018

Course profile: BIOE 4980/5980 Medical Internet of Things

University of Toledo, Department of Bioengineering. Spring 2022, section 054, cross-listed with BIOE 5980.

- **Format:** 3 credit hours; one hour of lecture and a three hour laboratory each week over 15 weeks; 16 graduate and senior undergraduate students; one supervised graduate teaching assistant at 10 hours per week; run on Blackboard.
- **How I came to teach it:** I supported the first offering as teaching assistant. The department chair then assigned me as instructor of record after observing two years of my laboratory and lecture teaching.
- **What I built:** the syllabus with learning outcomes mapped to ABET student outcomes, revised lecture decks, the capstone modules, instructor guides, laboratory guides, example code, four assignments, seven in class exercises, rubrics and a practical final examination. Several of the original lecture decks came from the first offering and were revised.
- **Structure:** weeks 1 to 6 covered microcontroller programming, digital and analog input and output, I2C and SPI, Bluetooth Low Energy and data handling. Weeks 8 to 14 were a capstone in which teams built an internet connected blood pressure monitor on the Arduino MKR WiFi 1010: circuit design and soldering, a MATLAB prototyped signal processing algorithm and its port to the microcontroller, WiFi and MQTT transport, and voice control through Amazon Alexa. Week 15 was a practical final examination.
- **Assessment:** in class activities 30 percent, assignments 40 percent, practical final 30 percent. The final was practical: each student demonstrated a working device and explained a design choice.
- **Continuity:** sessions were recorded so that students absent because of COVID-19 kept access. Four recorded sessions are available in the Teaching section of the portfolio.

Graduate teaching assistant, University of Toledo (2019 to 2021)

- Supported four core courses: Biomedical Signal Processing, Biomedical Electronics, Physiology for Bioengineers and Biomedical Instrumentation.
- Delivered lectures and recitations independently when the instructor was unavailable, and organized review sessions.
- Led two years of instrumentation laboratories in which students built ECG monitors on breadboards, acquired physiological signals and debugged devices that did not work.
- Wrote supplemental study guides and practice problem sets, and gave MATLAB and Python demonstrations drawn from real clinical data.
- Graded student work with written feedback.

Teaching assistant, KNUST (2017 to 2018)

- Taught across Cell Biology, Medical Imaging, Biomedical Optics, and Biomedical Electronics and Instrumentation, for several undergraduate cohorts.
- Learned to build intuition before formalism: in electronics I walked students through assembling a circuit by hand before introducing the mathematics that described it.
- Ran review sessions that gave students a second, lower pressure pass at difficult material.

How I support students

- **See every step.** I photographed each soldering step into a visual assembly guide that students followed at their own pace.

- **Start where you are.** Laboratory exercises were tiered, with optional extensions for fast starters, so students who had never seen a microcontroller and students who had written firmware completed the same capstone.
- **Learn from each other.** I paired students across experience levels, because the student who explains is the student who ends up understanding.
- **Guided struggle.** I ask teams to find the fault in a malfunctioning circuit before I touch it, then we troubleshoot together.
- **Never miss a class.** Recorded sessions meant illness or caregiving did not cost anyone the material.
- **Hear the quiet ones.** I check in with quieter students, and ask mid semester what is and is not working, then revise the next module.
- **Time at the bench.** Open office hours, specific written feedback, and one to one troubleshooting during laboratory time.

Courses I am prepared to teach

Biomedical Instrumentation and laboratory; Biomedical Signal Processing; Electronic Circuits and Biomedical Electronics; Bioelectricity; Physiology for Engineers and Quantitative Physiology; Medical Imaging Systems; Sensors, Measurement and Experimentation with statistics; Programming for Biomedical Engineers (MATLAB, Python, C); Numerical Methods for Biomedical Engineers; Machine Learning for Biomedical Data; Embedded Systems and the Medical Internet of Things; Computer-Aided Design and Rapid Prototyping (SolidWorks, 3D printing); Introduction to Biomedical Engineering and Engineering Design; Senior or Capstone Design.

Mentoring

- First doctoral student in the Technology Development Laboratory (2022 to 2026). I onboarded every incoming undergraduate and master's student in methods, tooling and experimental design, and established the analysis codebase, the version controlled and seed controlled workflow and the documentation conventions the laboratory still uses.
- At KNUST I ran an engineering club for the College's Trade and Technology Fair and taught first year students breadboard use, Arduino programming and sensor integration.

Research

Graduate Research Assistant, Technology Development Laboratory, University of Toledo College of Medicine and Life Sciences, August 2022 to May 2026. Principal investigator: Scott M. Pappada, Ph.D. I work on two connected projects, PREPARE and PreLapse, that share one question: what can a wearable honestly claim?

PREPARE: wearable based performance classification (DoD funded)

OBJECTIVE AND GOAL

Add objective physiological data to how performance is assessed in high fidelity simulation training, as a consistent second view for instructors: trainee physicians and EMS students now, with the program extending to military medical commands.

STUDY

- Prospective human subjects study under IRB oversight: 152 clinicians (Emergency Medicine and Anesthesiology residents and EMS students) in 470 high fidelity simulation sessions, each wearing an Empatica E4 wristband while faculty rated performance in real time.
- Empatica E4 streams: electrodermal activity 4 Hz, blood volume pulse 64 Hz, skin temperature 4 Hz, accelerometer 32 Hz.

- Quality screening reduced 2,584 raw assessments to 1,854 labeled events, with the exclusion criteria stated in the manuscript.

MY ROLE

- Led the machine learning development and wrote the MATLAB and Python signal processing pipelines.
- Designed the synchronization protocol that time aligns the wearable streams with instructor ratings.
- Per band filtering, individualized baselining from detected rest periods, and an automated sweep over 1,296 event centered window configurations. A genetic algorithm reduced 73 candidate features to 65.
- Trained and evaluated a feedforward neural network under subject level 20 fold leave-N-out validation, with class imbalance handled by inverse frequency weighting.

OUTCOMES

- The model classifies the performance category assigned by faculty at **84.5 percent balanced accuracy**, Matthews correlation 0.69 to 0.71, sensitivity about 93 to 95 percent and PR-AUC 0.97, against an 80.6 to 19.4 class imbalance.
- First author paper accepted at *Advances in Health Sciences Education* (2026, in press). The preliminary findings helped secure the \$1.1 million Department of Defense award.
- **Honest reporting.** When I found that a validation of my own had silently reused a single data split, I rebuilt it and reported the corrected result. A deep time series benchmark with self supervised pretraining did not beat the feature engineered pipeline at this sample size, and that negative result was reported, not discarded. Heart rate from the research device was benchmarked against an FDA-cleared Empatica Embrace worn at the same time.

PreLapse and BioPOD: wearable monitoring for opioid use disorder

OBJECTIVE AND GOAL

Build a wrist worn research wearable that records heart activity, motion, skin response and temperature in people recovering from opioid use disorder, to see the physiological changes that come before a relapse, early enough to act. Clinical validation is the next step.

MY ROLE

I built the device side, from board to app: sensor drivers and real time firmware in C on a Nordic nRF under Zephyr RTOS, a Bluetooth Low Energy transport whose packing scheme I designed, and PreLapse, the cross platform Flutter mobile app that collects, displays and exports the data.

THE FOUR SENSORS

SENSOR	MEASURES	DETAILS
MAX86141 (Analog Devices)	Optical pulse	SPI interface at 256 Hz with four sample averaging (64 Hz effective). Three LEDs (red, green, infrared) in separate time slots with two photodiodes, 3.5 mm apart. Green LED for heart rate; red and infrared for blood oxygen. On chip picket fence filtering.
LSM6DSO32X (STMicroelectronics)	Motion	SPI interface at 104 Hz; accelerometer to 16 g and gyroscope to 1000 degrees per second; continuous FIFO with watermark interrupts; embedded step counter and ambient temperature.
MAX30009 (Analog Devices)	Skin response	Skin conductance, also called electrodermal activity, front end.

SENSOR	MEASURES	DETAILS
MLX90632 (Melexis)	Temperature	Infrared, non contact skin temperature.

ENGINEERING PROBLEMS SOLVED

- FIFO overflows during long sessions, fixed with a dedicated high priority SPI thread and tuned watermarks.
- Ambient light sensitivity in the optical channel, reduced with black epoxy and custom 3D printed light shields.
- Several iterations of the photodiode and LED breakout board, after pad alignment and printing errors, while holding the 3.5 mm component spacing.

Funded research

Department of
Defense, CDMRP

PREPARE Operational Readiness Assessment

Congressionally Directed Medical Research Programs. Contract No. HT942524C0073. \$1.1 million. Principal investigator: Scott M. Pappada, Ph.D., University of Toledo.

The program partners academic institutions with Brooke Army Medical Center and the U.S. Air Force 59th Medical Wing, and was publicly announced by the University of Toledo on November 21, 2024. I am a graduate research assistant and contributor; the machine learning component builds on my dissertation pipeline and manuscript.

Publications

Journal article

McDaniel GH, Pappada SM, Alyosif Z, **Teye-Lartey SP**, Moussa M. The impact of stress and distraction on bag valve mask ventilation performance. *Cureus*. 2025;17(5):e84542.

Accepted, in press

Teye-Lartey SP, Schmieder J, Yadav U, Aouthmany S, Alvarado C, Jenkins K, Papadimos TJ, Toy S, Brickman K, Braida AL, Altenhof B, Pappada SM. Toward multimodal physiological assessment of clinical performance in simulation-based medical education: a machine learning approach. *Advances in Health Sciences Education*, accepted 2026, in press.

Preprint

Teye-Lartey SP, et al. Multimodal physiological assessment for clinical competency classification in simulation-based medical education: a machine learning approach. *Research Square*, February 22, 2026. doi.org/10.21203/rs.3.rs-8842924/v1

Published abstract

Schmieder J, Pappada S, **Teye-Lartey S**, Basaula S, Amedzekor H, Al Mamun E. PreLapse prototype software development for opioid use disorder patients. *Translation: The University of Toledo Journal of Medical Sciences*. 2024;13(S1):e1 to e2. Department of Neurosciences and Psychiatry Research Symposium.

In preparation

- **Teye-Lartey SP**. Recovering suppressed classification performance in physiological skill assessment: ensemble model selection and combined training on imbalanced multimodal data.

- **Teye-Lartey SP**, et al. Design and validation of a custom wearable physiological monitoring platform for opioid relapse prediction.

Presentations

- **Teye-Lartey SP**, Pappada SM, et al. Establishing a pathway to personalized training via multimodal assessment and artificial intelligence. Poster, 25th International Meeting on Simulation in Healthcare (IMSH), Orlando, Florida, January 2025.
- **Teye-Lartey SP**, Pappada SM, et al. Using artificial intelligence to personalize expertise development. Oral presentation, American College of Surgeons, Ohio Chapter, May 2024.

Honors and awards

- KNUST Excellent Student Award, 2015. College level award for academic achievement.
- Provost's List, KNUST, 2015 and 2016.
- First Class Honours, B.Sc. Biomedical Engineering, KNUST, 2017 (CWA 76 of 100).
- Certificate of Honour as President of the Biomedical Engineering Students' Society (BMESS), KNUST, 2017.
- Certificate of Honour for Executive Council service, GESA, KNUST, 2017.

Leadership and service

2016 to 2017

President, Biomedical Engineering Students' Society (BMESS), KNUST

Organized technical seminars, symposia and industry field trips, and ran an engineering club for the College's Trade and Technology Fair, where I taught first year students breadboard use, Arduino programming and sensor integration. For many of them it was the first time something they had built worked.

2016 to 2017

Executive Council, GESA, KNUST

Coordinated logistics for departmental events, outreach and academic programming.

2015 to 2016

Organizing Secretary, BMESS, KNUST

2022 to 2026

First doctoral student, Technology Development Laboratory

Onboarded and mentored every incoming undergraduate and master's student, and built a laboratory culture where questions are welcome and mistakes are treated as information.

Professional development and certification

- 25th International Meeting on Simulation in Healthcare (IMSH 2025), Orlando, January 10 to 14, 2025. Attended the full jointly accredited interprofessional continuing education program and presented a poster.
- On Being a Scientist (INDI 8020), responsible conduct of research, University of Toledo, Spring 2022.
- CITI Program, Human Subjects Research certification, valid to January 2029.
- IEEE Circuits and Systems Society workshop, KNUST, 2017.

Skills

Teaching. Course design from syllabus to capstone; project based and flipped instruction; laboratory instruction in circuits, instrumentation and signal acquisition; scaffolded assessment for mixed preparation cohorts; supervision of teaching assistants; Blackboard and Canvas; recorded and hybrid delivery; one to one mentoring.

Engineering and computing. Python (NumPy, SciPy, pandas, scikit-learn, PyTorch, TensorFlow), MATLAB, C, SQL, Dart and Flutter; Arduino and Nordic nRF microcontrollers; Zephyr RTOS; I2C, SPI, UART, Bluetooth Low Energy, WiFi and MQTT; SolidWorks and 3D printing; EAGLE; soldering and prototype fabrication; oscilloscope, multimeter and signal generator; Git and Linux.

Research methods. Physiological signal processing (FIR, IIR, wavelet, time frequency); feature engineering and genetic algorithm selection; machine and deep learning for time series; subject partitioned cross validation and leakage testing; metrics for imbalanced data; reference device benchmarking; design of experiments; human subjects protocols and IRB documentation.

Relevant graduate coursework

Advanced Biosignal Processing; Medical Imaging Systems I; Survey of Diagnostic Medical Imaging; Computational Physiology; Physiology and Anatomy for Bioengineers; Machine Learning; Machine Learning Applications for Bioengineering; Biologically Inspired Computing; Design of Experiments; Advanced Engineering Mathematics I and II; New Venture Creation. Cumulative GPA 3.63 of 4.0.

References

Contact details are available on request through the email address above.

- **Scott M. Pappada, Ph.D.** Associate Professor, Department of Anesthesiology; adjunct faculty, Department of Bioengineering, University of Toledo College of Medicine and Life Sciences. Doctoral advisor and principal investigator.
- **Brent D. Cameron, Ph.D.** Professor and Chair, Department of Bioengineering, University of Toledo College of Engineering. Doctoral committee member; assigned me as instructor of record and observed my teaching across four years as a graduate teaching assistant.
- **Shaza Aouthmany, M.D.** Associate Professor, Department of Emergency Medicine, University of Toledo College of Medicine and Life Sciences. Doctoral committee member and clinical collaborator on the PREPARE program.

Last updated October 2026.