

January 8, 2021

Dear Black Trailblazers in Engineering (BTE),

As I enter the final stage of my PhD in Bioengineering, I contemplate what my next steps should be in preparation for a future faculty position. I find it difficult to navigate the path that I have chosen because I am the first in my family to reach the PhD level. It is my belief that the BTE program is exactly what I need to successfully guide me towards a tenure-track faculty position.

My passion lies in teaching STEM, mentoring the next generation of scientists and engineers, and addressing healthcare issues in the African American community. These passions are the reason I have sought to obtain a PhD in Bioengineering. It is my belief that improving the outcomes for our community is directly linked with properly educating, cultivating, and providing opportunities for more African American STEM students, many of which are first-generation or low-income college students.

My PhD thesis focuses on Novel Noninvasive Optical Diagnostic Technologies for the Management of Neonatal Jaundice by combining optical spectroscopy with device engineering to develop a low-cost, high-resolution mobile phone-based bilirubinometer. Neonatal Jaundice is a health condition that can lead to brain damage and even death in African American neonates if not properly diagnosed and treated. While Neonatal Jaundice is an easily treatable condition, noninvasive diagnosis in highly pigmented infants is challenging and can lead to overestimation of bilirubin values. Since all of my siblings were born with this condition, it feels extremely rewarding to work on technology that focuses on addressing health issues that directly impacts other African Americans.

When I am not working on my research, I also teach and mentor African American students at Cheyney University of Pennsylvania, a historically black university and my alma mater. I have also been recently appointed as a TRIO Program Specialist serving a student support system. Trio is a federal outreach and student services program designed to identify and provide services for individuals from disadvantaged backgrounds. In this position, I provide students with supplemental activities that will not only complement what they are learning in STEM classes, but also groom them with skill sets needed to succeed and excel in a STEM career. These activities include tutoring, critical thinking exercises, and activities where students work together to build prosthetic devices. My hope is that these students will build academic knowledge and gain skills to benefit them in their future careers. More African Americans in the STEM

field improves economic growth and may help improve poor health outcomes by having a stronger focus on research areas that directly impact our communities.

The best way that I can serve my community is by encouraging and raising up other African Americans behind me so that we can change our outcomes together. Ideally, I have always believed that I would pursue this work at an HBCU because there is a greater population of minority students at these institutions. However, I have come to the realization that I want to be a part of minority students' development no matter what college they go to. As a faculty member, I want to serve schools where I can primarily focus on education and mentoring. While research is still a passion of mine, I would prefer that it be my secondary objective.

I know that the BTE program is geared towards setting future black educators up for success and molding individuals like me into being the best candidates that they possibly can be. I am confident that my participation in the BTE program will help me reach my goal of educating and mentoring minority students. It would be an honor and privilege to be a part of this program at an institution whose initiative aligns with my own aspiration for the African American community.

Thank you,  
Brandon Harrison

### Statement of Teaching Philosophy

My longstanding goal to become a university professor is rooted in a desire to teach and mentor students. Throughout my education, I have observed methodologies used by my past teachers and I have contemplated what methods have been influential to my own growth and learning. As I observed, I would amass a collection of strategies that I would then apply as a tutor, teaching assistant, and adjunct professor. It is my belief that the best teachers continuously evolve in response to the needs of their students and emerging approaches to teaching.

Teaching Philosophy: I believe the most challenging aspect of educating scientists and engineers is to **foster critical thinking and well-developed problem-solving skills** while imparting the core technical curriculum. **I am a strong advocate of problem-based learning (PBL)** modules to help develop these qualities. Throughout my teaching experiences, I realized that the goal I had for myself was to gift my students with a skill generally known as designed thinking. Designed thinking is an outlined work process for extracting information, defining a problem, developing an innovative or creative way to solve the problem, prototyping, and testing. With this skill, my STEM and non-STEM students have shown to be independent and empowered thinkers that are able to solve their own problems.

To accomplish this, I need to bridge design thinking and scientific theory with current scientific literature. In my experience, this is best accomplished through lecturing, journal article presentations, and proposal writing. My lectures serve as the foundational pieces in which students start to understand scientific theory. The scientific theory that is reviewed will provide them with supplementary material for breaking down future journal articles. Scientific articles are either chosen by the student or myself and are based on the theory that was previously taught. Then the student will present the journal article to the class highlighting the problem statement, scientific theory, methodology, data and a discussion about the results.

I put this teaching into practice when I taught Bionic Human at Temple University. I would spend three days reviewing background information about optics and different Biophotonics techniques. Following my lecture, a group of students presented on a previously discussed technique, optogenetics as a method for exploring neuronal networks to treat chronic neuropathic pain. Following the presentation, questions and discussions are conducted by the students and myself.

This way of teaching familiarizes students with current research, while promoting the development of skills in critical thinking and argument development. During this process, students also observe how current researchers evaluate problems, solutions, and utilize different methods and testing of their solution. This reinforces the designed thinking skill and helps push the students forward to the next assignment, which is creating a proposal of a

solution for an unmet need. The proposal gives me insight on the students' understanding of designed thinking and the opportunity to evaluate their writing proficiency.

In my experience executing problem-based education, I have found that it is crucial that **the instructor have a firm grasp on the hierarchy of learning objectives**. I have learned to create concept maps that stratify and inter-relate content into categories of "what is essential to know", "what is good to know," and "what is not important to know." These maps help me to form the lines of questioning that I use to direct students towards a clear understanding of foundational concepts, and they also allow me to formulate quick assessments of the efficacy of my daily lectures. For instance, after each class, I try to leave 2-3 minutes where I ask the students to write the 1-3 most important things that they learned. I can compare their responses to my concept maps and quickly understand if foundational concepts will require closer attention in the next class, and which portions of the lecture will need revision in future iterations of the course. Ultimately, I am confident that **my focus on fostering inquiry and problem-solving skills coupled with my willingness to adapt will allow me to succeed** as an engineering instructor and mentor of undergraduate and graduate students.

Potential Courses to Be Taught and Developed: I have a strong background in teaching optics, chemistry, signal processing, and biology. In a group teaching format, I could contribute modules on biomedical optics, optical coherence tomography, and optical spectroscopy to relevant courses. I would be interested in developing undergraduate courses and labs in biomedical signals and systems, as well as Engineering Proposal Design. Finally, I would like to develop an advanced undergraduate/graduate course entitled "Introduction to Biomedical Optics" and a graduate special topics course in Optical Diagnostic Devices.

### Statement of Research

Overview: The goal of my research is to develop optical imaging and spectroscopy as **platform tools for non-invasive diagnosis, therapeutic guidance, and characterization of novel biotechnologies**. Optical imaging and spectroscopy encompass a versatile set of tools for **non-invasive, molecularly specific** measures of tissue composition, along with **micron-scale resolution** images of tissue structure. The combination of imaging with spectroscopy is an exciting research direction because both microstructural and compositional information are often necessary to address the diverse set of challenges that face both medicine and engineering. Fiber-optic devices can **improve surgical precision and reduce complications through real-time, high-resolution intraoperative guidance**.

The paradox of novel medical technologies is that they can increase global socioeconomic disparities in healthcare outcomes from neonates to adults. Optical diagnostics are unique in that they can often be implemented with cheap consumer electronics that are now omnipresent even in low-resource settings. My research has developed a simple approach that modifies the camera and flash on a mobile phone to easily perform well-developed optical

diagnostics based on diffuse reflectance measurements of tissue, such as diagnosis of neonatal jaundice or screening for oral cancer. These tools can assist frontline healthcare workers, simplify communication with high-level regional healthcare centers, and ultimately reduce disparities through improving early detection rates in low resource settings. My work has shown the value of this approach in screening for neonatal jaundice, and I plan to extend this technique to screening for oral cancers, or other transcutaneous issues.

## **I. Professional Preparation**

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**Temple University, Philadelphia, Pa** **May 2021**

Doctorate in Biomedical Engineering  
Dissertation: “Mobile Phone Based Transcutaneous Bilirubinometer”

**Future Faculty Development** **March 2019**

2019 IGNITE W&M Future Faculty Development Program  
William and Mary, Williamsburg, VA

**Temple University, Philadelphia, Pa** **December 2016**

Master of Science in Biomedical Engineering

**Cheyney University of Pennsylvania, Cheyney, Pa** **May 2010**

Bachelor of Arts in Chemistry

**Pennsylvania State University, University Park, Pa** **August 2008**

Associate Degree, Nanofabrication Manufacturing and Technology

- Trained on Applied Materials P5000 MERIE – Dektak 6M profilometer, Plasma Therm SLR 720 RIE – Tencor Alpha Step 500, Edwards 306A thermal evaporator – Veeco diCP II AFM, Cooke Vacuum CVE 301 thermal evaporator – Leica SEM 440, Cooke Vacuum CVE 301 thermal evaporator – Technique 80 micro RIE, Gaertner 1155-8 ellipsometer, and Karl Suss MJB3 contact lithography system in a state-of-the-art class 10/100 clean room.

## **V. Honors and Awards**

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Keystone Honors Student (2006-2010)

Bond-Hill Scholar (2017-2020)

Research Awards

- 2017 and 2018 Undergraduate Mentee’s Winners of Bioengineering Undergraduate Summer Research Symposium Outstanding Poster.
- 2019 2<sup>nd</sup> place Bioengineering Graduate Summer Research Symposium Outstanding Poster.

## **IV. Publications**

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**Manuscripts in Preparation**

1. **B. Harrison**, A. Dumont, J. So, S. Chandragiri, Z. McCormack, A. Nwaba, H. Weitkamp, and C.A. Patil, "Mobile Phone Based Transcutaneous Bilirubinometry Preclinical Study" in preparation for submission to *Biomedical Optics Express*.
  2. A. Dumont, **B. Harrison**, J. So, S. Chandragiri, and C.A. Patil, "Monte-Carlo Modeling of Melanin Dependent Variability in Transcutaneous Bilirubinometry" in preparation for submission to *Biomedical Optics Express*.
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### Conference Abstracts/Proceedings

1. A.P Dumont, Y. Sun, **B. Harrison**, J. So, and C.A. Patil "Validation of an Accelerated Raman Monte-Carlo Model for Determining Spatial and Spectral Thresholds for Calcification Detection in Tissues", BMES Annual Conference, October 16-19, 2019, Philadelphia, PA (poster).
2. **B. Harrison**, A.P. Dumont, Z. McCormick, A. Nwaba, S. Grossarth, H. Weitkamp, and C.A. Patil, "Development and Validation of a Mobile Phone Based Transcutaneous Bilirubinometer", BMES Annual Conference, October 16-19, 2019, Philadelphia, PA.
3. **B. Harrison**, A.P. Dumont, J. So, S. Chandragiri, A. Nwaba, S. Grossarth, Z. McCormick, H. Weitkamp, N. Lawal, A. Muhammed, Z.L. Farouk and C.A. Patil. "Development of a Mobile Phone Based Transcutaneous Bilirubinometer," Northeastern Biomedical Engineering Conference (NEBEC), March 20, 2019, New Brunswick, NJ (oral).
4. **B. Harrison**, A. Dumont, Z. McCormack, H. Weitkamp, and C.A. Patil, "Mobile Phone Based Transcutaneous Bilirubinometry Preclinical Study" Biomedical Engineering Society (BMES) Annual Conference, October 18, 2018, Atlanta, GA (poster).
5. Y. Sun, M. Haifler, **B. Harrison**, A.P. Dumont, and C.A. Patil, "Two-stage Local Outlier Factor for Multivariate Identification of Outliers in Optical Spectroscopy and Imaging", Biomedical Engineering Society (BMES) Annual Conference, October 18, 2018, Atlanta, GA (poster).
6. N. Mucciolo, K. Sareeram, **B. Harrison**, A. Dumont and C.A. Patil, "Development of New Reference Standards in Mobile Phone-Based Bilirubinometry", BMES annual conference, Atlanta GA, October 18, 2018. (poster).
7. **B. Harrison**, A. Dumont, Z. McCormack, A. Nwaba, H. Weitkamp, and C.A. Patil, "Development of the 2<sup>nd</sup> generation Mobile phone based transcutaneous bilirubinometer", Northeastern Biomedical Engineering Conference (NEBEC) March 30, 2018, Philadelphia, PA (oral).
8. **B. Harrison**, A. Dumont, Z. McCormack, H. Weitkamp, and C.A. Patil, "Mobile Phone Based Transcutaneous Bilirubinometry", Biophotonics in Low Resource Settings III, 2018 SPIE Photonics West, San Francisco California (oral).
9. J. So, S. Chanragiri, **B. Harrison**, A. Dumont, and C.A. Patil, "Optical Phantoms for Mobile Based Diagnosis" accept for poster presentation at BMES annual conference, Phoenix AZ, October 12-15, 2017.



10. A. Dumont, **B. Harrison**, Z.T. McCormick, N. Ganesh-Kumar, C.A. Patil, “Development of mobile phone based transcutaneous bilirubinometry” presented at Optics and Biophotonics in Low-Resource Settings III, SPIE Photonics West, San Francisco California, Jan 29, 2017 (Oral).

### **III. Appointments and Teaching Experience**

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#### **Professional Tutor**

**Aug 2015 - Present**

Academic Success Center, Cheyney University, Cheyney, Pa

- Supplementary Instruction Services
  - Tutoring students individually and in small group settings in math, science, oral and written communication.
  - Assisting students in developing in-class and out-of-class strategies for academic success.
- Mentored first-generation/low-income college students.
- Career Counseling

#### **Adjunct Professor, Biology Lab**

**Fall 2020**

General Science Department, Cheyney University, Cheyney, Pa

- Asynchronous Lab Instruction
- Instructor Teaching Rating 4.8/5.0

#### **Adjunct Professor, Bionic Human**

**Spring 2020**

Department of Bioengineering, Temple University, Philadelphia, Pa

- Lectures on Bioethics, Domestic and Global Healthcare, Current Medical Technologies.
  - Promoting critical thinking and communication skills.
- Instructor Teaching Rating 4.9/5.0

#### **Graduate Teaching Assistant**

**Spring 2019 - Fall 2020**

Frontiers in Bioengineering

Department of Bioengineering, Temple University, Philadelphia, Pa

- Graded variety of written assignments (scientific proposal sections, special topics reviews)

#### **Graduate Research Assistant**

**2017 - Present**

Optical Diagnostics Research Laboratory

Department of Bioengineering, Temple University, Philadelphia, Pa

- Developed Mobile Phone Based Transcutaneous Bilirubinometer.
- Organized multidisciplinary teams, project planning and execution activities.
- Mentored undergraduate research students.



- 2017 and 2018 Winners of Bioengineering Undergraduate Summer Research Symposium Outstanding Poster.
- Submitted and presented abstracts/proceedings at multiple scientific conferences.

## **II. Related Research/Lab Experience**

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### **IBM T.J. Watson Research Center**

**2010 - 2014**

Engineer Assistant, Yorktown Heights, NY

- TEM sample prep for failure analysis.
- Cut samples for FIB cross sectioning, in-situ and ex-situ samples.
- Polishing TEM samples and SEM Cross Sectioning.
- Maintained lab and ordered supplies.
- Trained on FIB 200TEM/ Dual Beam FIB 450, Cr tool/ Au Coat tool/ TEOS coating tool, tripod polishing, laser marking tool, and OSHA Yearly Safety.

### **U.S. Department of Agriculture**

**Aug 2010 – Dec 2010**

Lead Lab Technician - Catfish Study, Philadelphia, Pa

- Collected data each week and summarized a report.
- Tested fish for bacteria including e. coli and salmonella by incubating the pieces in different solutions.
- Maintained a safe working environment, lab cleanliness, and stocked lab supplies.

### **Cheyney University of Pennsylvania**

**May 2010 – Aug 2010**

Summer Lab Assistant – Plant Alkaloid Extraction Study, Philadelphia, Pa

- Extracted chemicals from underwater plants that had been collected in Jamaica.
- Performed Alkaloid test on herpes II virus and TLC of plant extraction.

Black Trailblazers in Engineering  
College of Engineering  
Purdue University

Re: Letter of Recommendation for Brandon Harrison

Dear Members of the Evaluation Committee,

It is with great enthusiasm that I write this letter of recommendation for Brandon Harrison's application to your new initiative, Black Trailblazers in Engineering. **I have no doubt that Brandon will be a pioneer in engineering health technologies and serve as a role model for our next generation of engineers.**

Brandon received a BA in Chemistry from Cheyney University of Pennsylvania in May 2010. He was selected to receive a **Keystone Honors Scholarship, which provides full scholarships to academically gifted students.** After graduation, he was an **Engineer Assistant** at the IBM Thomas J Watson Research Center in Yorktown Heights from 2010 - 2014. During these 4 years, Brandon developed quite a numerous set of technical and analytical skills that have served him well as he continued his education to obtain a MS in Bioengineering from Temple University in December 2016. Notably, Brandon received a **Bond Hill Scholarship, which awards recipients with full funding, to continue pursuing his PhD in Bioengineering.** His thesis focuses on developing novel noninvasive optical diagnostic technologies, with special motivation to address disparities in diagnosing patients with pigmented skin. **Brandon's PhD thesis is novel and will provide essential low-cost, high-resolution technologies to help address systemic health disparities.** His exciting research has been presented at multiple national conferences, has been selected as our 3<sup>rd</sup> best poster at the Temple Bioengineering Research Symposium, and will result in at least two manuscripts. Brandon is on track to defend and receive his PhD in Bioengineering from Temple University in May 2021. Additionally, with regards to his potential for success in academia, he was previously selected as an IGNITE-Future Faculty participant at William and Mary. **Brandon's impressive personal drive and leadership, interdisciplinary and impactful research, and creative problem solving abilities will help him excel in academia.**

In Spring 2019, Brandon was my **Graduate Teaching Assistant** for my BioE 2001: Frontiers in Bioengineering course, comprising 31 undergraduate freshmen and transfer students. Though this introduces the vast field of bioengineering, it is by no means an easy introduction, as we identify problems or limitations with current bioengineered technology and assess current state-of-the-art solutions. The topics we cover encompasses a wide-breadth of bioengineering sub-fields ranging from neuroengineering to biophotonics to mechanobiology. I had students submit multiple individual assignments, response essays to bioengineering problem statements, group

presentations, final project assignments, a final project presentation, and a final project group report. Throughout the course, **Brandon was a vital resource** in aiding me with providing timely constructive feedback to student group assignments. **He was integral in students' growth in the class by guiding them** to clarify their bioengineering problem, current state-of-the-art solutions and their limitations, novel scientific design that addressed specific limitations of the current solution, methodology to test their novel design, patentability, clear project milestones to bring it to market, and furthermore, any possible ethical concerns that would arise from the novel solution. Additionally, I was fortunate that this Spring of 2020, Brandon was again able to be a Graduate Teaching Assistant for my BioE 2001 class, which comprised 35 undergraduates. **His familiarity with the course was essential and played a large role in the seamless transition to remote teaching** mid-way through the semester due to the COVID-19 pandemic safety measures.

Also, I am certain that Brandon's outstanding performance as a Graduate Teaching Assistant contributed to **our department inviting him to teach a section of our GenEd course, BioE 0844: The Bionic Human, as an Adjunct Professor**. This is a successful and popular course for non-engineering students, with 8 sections each usually comprise 30+ students. I have also taught this course, and it is a wonderful way to hone one's science communication skills while also increasing student's scientific literacy. The course introduces the scientific method and how to think critically, identifies and evaluates pseudo-science, introduces new technologies and materials developed by engineers and scientists, discusses the ethics behind these technologies, evaluates the structure of the US healthcare system, and introduces the science behind the technologies currently used in medicine. **Brandon excelled at teaching this course**. I am proud to share some quotes from of Brandon's BioE 0844 student evaluations. These are **a few of the glowing evaluations he received**: (i) "Brandon was very approachable and encouraged a lot of discussions and [answered our] questions. He would also include topics that we wanted to learn into the course;" (ii) "He was able to communicate really well, with me especially when I needed help since I had an incomplete in a previous class due to family issues and he was flexible [in] understanding and got me back on track;" (iii) **"I am so happy to see a Black Professor! Seeing another person of color and who is striving [towards success] and getting their PhD is so encouraging;"** (iv) "I loved this class and I encourage a lot of people to take the class;" (v) "One of my top 3 professors through my whole time [at] Temple." **Additionally, Brandon continues to maintain a close relationship with his alma mater, Cheyney University**. He teaches and mentors STEM students individually and in small groups. He has also served as an Adjunct Professor in their General Science Department, teaching Biology Lab. Notably, Brandon was recently appointed as a TRIO Program Specialist, a federal outreach program that provides services for individuals from disadvantaged backgrounds. These are just **a few examples of how Brandon has demonstrated an extraordinary passion for teaching and mentoring**.

**Brandon has stood out as an exceptional graduate student in our Bioengineering department with remarkable potential to succeed.** It has been an absolute pleasure to work with Brandon in and outside of class. I am not Brandon's thesis advisor, but I was a member of his Preliminary Exam Committee in November 2018. I am also an unofficial mentor. Brandon is resilient to my constructive criticisms and gentle pushes during our many discussions. He takes my comments as opportunities to continually push himself to excel. **I have high expectations for Brandon and know he will far exceed them.**

I, myself, was a participant for Purdue's Prospective Faculty Workshop, which was an invaluable experience, as a first generation college and graduate student looking to continue into academia. When I discovered that there was this new initiative at Purdue, specifically for Black engineers, I knew Brandon would be a great candidate for it and sent him the opportunity. Distinguished programs such as yours, would be a fantastic opportunity for Brandon to interact with notable engineering leaders and potential future mentors for him. **Brandon intends to be a tenure-track engineering faculty member at an HBCU**, and I hope programs such as yours, will help provide some of the stepping stones to help him succeed in his future career goals.

**I strongly support Brandon's application for your Black Trailblazers in Engineering program and I hope you will give him full consideration.** Brandon is highly intelligent and motivated, with unique interdisciplinary training. I have no doubt he will be fully devoted to his research, teaching, and the success of his students.

Please do not hesitate to contact me for any additional information. Thank you.

Sincerely,



Karin Wang

January 8, 2021

To Whom It May Concern:

I am pleased to be writing this letter of recommendation on behalf of Brandon Harrison to the BTE Program. Brandon is a PhD candidate in the Bioengineering Program at Temple University in Philadelphia. He is nearing completion of his degree and is starting to explore employment options in academia.

I have known Brandon since he was a Masters candidate in our department in 2016, when I started my position as the department's Graduate Coordinator. Most recently, he has been a teaching assistant in a freshman survey class that I teach, Frontiers in Biomedical Engineering. Brandon's responsibilities have included grading students' writing assignments and being the lecturer when I could not be there. He has been an exemplary TA. As a teaching faculty, I have been able to interact with 10 TA's and Brandon has by far been the best. He gives the students good feedback when grading their writing assignments and he is diligent in doing so in a timely manner. Beyond that, Brandon has been proactive in asking questions about the reasons for the assignments and making suggestions about changes to improve them. I see great potential for him in a future academic career.

Brandon has also had an opportunity for some adjunct teaching experience, teaching a General Ed course called The Bionic Human at Temple and as a Biology Lab instructor at his alma mater, Cheyney University of Pennsylvania. Brandon has also been selected by our Graduate School for a Future Faculty Fellowship, covering his summer stipend for research work in Summer 2021.

Temple prides itself on its diversity of faculty and student body. As a new department, started in 2012, we have exceptional diversity for an engineering department. Our faculty are 43% female and but only 20% minorities. Amongst our graduate students, we have 44% females and 47% minorities, Brandon Harrison among them. We do not have many mentors that Brandon can approach to learn more about the unique challenges that face him as a minority faculty in the STEM field. I think that the BTE will be a wonderful opportunity for Brandon to experience the mentorship and networking that will help him succeed. I have no doubts that he will be a wonderful educator and role model for future engineers. **I highly recommend that you accept Brandon Harrison to the BTE program.**

Sincerely,



Yah-el Har-el  
Assistant Professor  
Department of Bioengineering  
Temple University