



IUPUI

DEPARTMENT OF BIOMEDICAL
ENGINEERING

SCHOOL OF ENGINEERING AND TECHNOLOGY

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Purdue University Degree





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SCHOOL OF ENGINEERING AND TECHNOLOGY, IUPUI

723 W. MICHIGAN STREET, ROOM SL 220
INDIANAPOLIS, INDIANA 46202

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THE

BME

NETWORK

Newsletter of the Department of Biomedical Engineering

FALL 2022
ISSUE # 15

“Follow your Heart.”

As of the ‘21-22 academic year, Dr. Edward Berbari has formally retired from the Department of Biomedical Engineering. Considering Dr. Berbari initiated our campus’s department, all we have today we owe to him. Retirement is often a time for critical reflection. What better time than now to feature the man who started it all. When asked what advice he would have for unsure, 20-somethings navigating their college careers, Dr. Edward Berbari had this to say:

“There are jobs for Biomedical Engineers. The job should not be the driving factor. Follow your heart, do what you want to. If you already want it, Biomedical Engineering alone poises you for greater success.”

Picture late ‘60s Carnegie Mellon. If you think Biomedical Engineering (BME) is underdeveloped today, it was almost nonexistent when Dr. Berbari was a student. If he wanted to know more, he couldn’t ask a professor about career options in the field. Instead, he found solace in his university library finding journals that described BME pursuits without explicitly identifying as “Biomedical Engineering.” He

walked away from Carnegie Mellon as a first-generation college student with a Bachelor's in Electrical Engineering. His journey is much like many Biomedical Engineering students today, in that at one point, medicine interested him. He was the second student to enroll in the “Hospital Internship” course. Through meaningful, clinical immersion, Dr. Berbari could see how engineering could serve the medical field.



“For this internship I had a room there of my own. I got 3 meals and a bed. I would be on call with the interns and residents and was able to observe autopsies, child births, and many types of surgeries and many clinics.”

For an entire semester he lived at the hospital alongside doctors and residents. Given a room and three-square meals a day, he got to see in real time the inner workings of a medical facility and all the instrumentation engineers provide for them.

As a senior, it was past his time to become a medical student. He went off to get his BME Master’s at Miami University, it was an uncommon degree for the time. At 23, his Master’s thesis on High Resolution Electrocardiography was first published by the *American College of Cardiology*. By 1977, newly married, he was off to the University of Iowa to get his PhD in Electrical Engineering.

So how did he end up at IUPUI? After getting his PhD, he was actually a medical faculty member with the Oklahoma University of Health Sciences Center for 14 years before he joined the IU team! When he was offered the position of Chair of Electrical Engineering at IUPUI, he accepted, recognizing it was a step towards building the Department of Biomedical Engineering. For six years, he held his position as Chair while fellow professors Dr. Schild and Dr. Yokota helped



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piece together the BME graduate curriculum that began in 1994.

“Dr. Yokota and Dr. Schild were alongside me from the beginning...In 1996, our joint campus joined the PhD program with Lafayette. Our first class was in 2004 for BME undergraduate programs.”

And from there, the rest is history. For the past two years, our BME

curriculum has radically changed, offering a greater selection of coursework and profound extra-curricular opportunities. From research endeavors to summer internships, The BME Network proudly boasts a tight-knit community with invaluable experience for our undergraduates, graduates, and PhD students. While we take great pride in our tireless efforts to offer a competitive curriculum, it would be shameful not to recognize

the tireless efforts of the man who started it all. Dr. Berbari, Dr. Yokota, and Dr. Schild planted the seeds for the program we know today and for that we thank them endlessly. We wish Dr. Berbari a rich and restful retirement with friends and family. From all of us at The BME Network and IUPUI’s Department of Biomedical Engineering, thank you, Dr. Berbari.

Noninvasive Technique for Detection of Electrical Activity During the P-R Segment

By EDWARD J. BERBARI, M.S., RALPH LAZZARA, M.D., PHILIP SAMET, M.D., AND BENJAMIN J. SCHERLAG, Ph.D.

SUMMARY

Many recent clinical studies of the His-Purkinje system have utilized intracardiac catheter recordings. This study describes a technique for recording activity of the ventricular specialized conduction system from the body surface. Unlike the standard electrocardiographic signals, approximately one mV at the body surface, the electrical activity of the His-Purkinje system is in the microvolt range.

In 15 anesthetized dogs, the His bundle electrogram (HBE) was recorded. The HBE was amplified, filtered, and integrated to the surface random electrical activity. The relationship between the HBE and the surface ECG was constant at all pacemaker rates. The HBE amplitude was 29 ± 2 μV. The HBE amplitude was constant at all pacemaker rates. The HBE amplitude was 29 ± 2 μV. The HBE amplitude was constant at all pacemaker rates. The HBE amplitude was 29 ± 2 μV.

Additional Information: His bundle recording in anesthetized dogs.

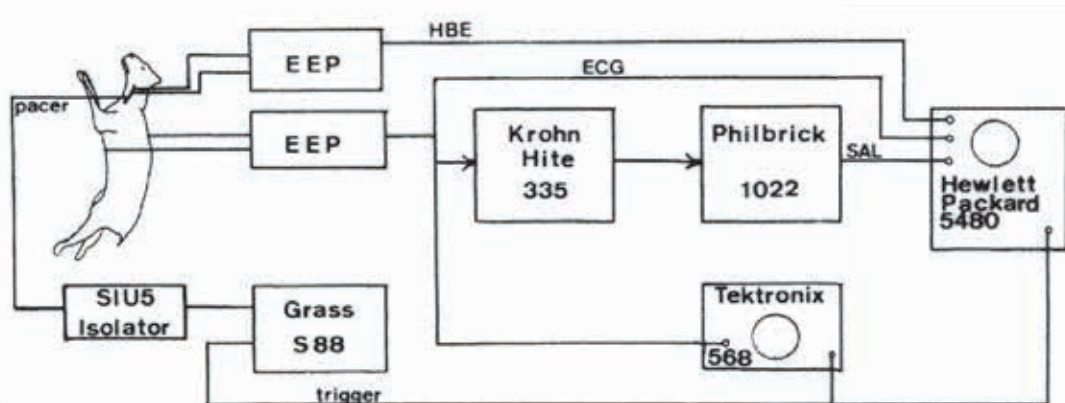


Figure 1

Block diagram of the system. The E for M EEP channels provides the first stage of amplification for the electrocardiogram (ECG) and His bundle electrogram (HBE). The ECG lead is filtered (Krohn-Hite 335) and further amplified (Philbrick 1022) before being sent on to the signal averager (SAL). The Tektronix oscilloscope is used for monitoring the time between the trigger pulse and the QRS. SAL = surface averaged lead.

Excerpts from Dr. Berbari’s 1973 master’s thesis published in *Circulation, An American Heart Association Journal*



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INTRODUCING OUR...

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SPOTLIGHT!

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Our Undergraduates



Safia Shakil

You may recognize Safia's face on our department's website. After interning with Helmer Scientific last summer, junior Safia Shakil reflects on why she chose BME. "I have always been interested in improving human health." Safia utilizes her creativity and problem-solving to achieve this ideal. Our department is proud to know and teach Ms. Safia Shakil.

Edwin Quinones

As a student in the MURI program, Edwin focuses on tissue engineering, "which is a topic that interests me the most." Last summer as a MURI team member, Edwin's project used 3D printing to redesign and print ear ossicles. Edwin encourages all students to reach out and find what they love, "success is not a gift; it's a skill."

Our Graduates



Nathaniel Lazorchak

Nathaniel has wasted no time in his 5-Year MS/BS BME thesis program. Nathaniel's journal article on *in-silico* work has been approved for publication. In July he got to travel to Rotterdam with Dr. Ken Yoshida to present his work on the window between Low Frequency Alternating Current (LFAC) activation and block. Not everything came easily. Nathaniel writes, "you're not going to walk in knowing the answer to every question...try not to get discouraged."

Nathan Dimmitt

Nathan D. assists with Dr. Lin's lab and hopes to get his first first-author publication by the for a piece currently under review. Nathan has just finished his first year in the PhD Biomedical Engineering program at the IUPUI campus and believes any student can get involved with lab work. "A great place to start in the literature is recent review papers, which was advice given by Dr. Schild in my critical literature analysis class."



Introducing... Dr. Rachel Surowiec

"There is really nothing like the energy that comes from those sessions where students are having a breakthrough at grasping a concept that had once seemed impossible," Dr. Surowiec tells the BME Network. The La Porte, IN native is back home as our newest faculty member. First, a master's degree in Biomechanics at Ball State University and from there she was off to the Imaging Research Department at the Steadman Philippon Research Institute in Vail, Colorado. After completing her PhD in Biomedical Engineering with a concentration in Biomedical Imaging at the University of Michigan, Dr. Surowiec tackles imaging and spectral biomarker developments. She hopes to develop early disease detection mechanisms in her lab in order to help us identify novel therapeutic targets.



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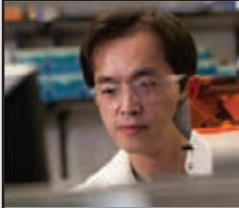
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IUPUI Biomedical Engineering professor, Chien-Chi Lin, receives NSF Career Award

In 2015, Dr. Lin was awarded the NSF Career Award. Four years later, his work was awarded a \$1.5 million grant from the National Institutes of Health for Pancreatic Cancer.

Since 2020, Dr. Chien-Chi Lin was appointed the Thomas J. Linnemeier Guidant Foundation Endowed Chair. Despite being appointed in unprecedented times, Dr. Lin has made quick work of his position. “Lin is one of a very few engineering faculty members nationwide serving as PI on an RO1 awarded by NIH’s National Cancer Institute,” (Ray, 2021). His active RO1 grants are plentiful and include NIH/NIDDK, NIH/NC, and NIH/NCI. Dr. Lin’s recruited graduate students supporting his work generate quality research of their own,

including PhD student Han Nguyen’s 2021 publication to the *Biomacromolecules Journal* (“Probing osteocyte functions in gelatin hydrogels with tunable viscoelasticity”). With the help of graduate student Nathan Dimmitt, Dr. Lin and Dimmitt have announced a patent disclosure this year on the expansion of pluripotent stem cells (“Xeno-free polymers for expansion of pluripotent stem cells”. Invention disclosure. 2022). The BME Network takes pride in Dr. Lin’s commendable work!



PhD students Han Nguyen (left) and Nathan Dimmitt (right) work alongside Dr. Lin. The BME Network is proud of their commitment to helping our BME professor and just as proud of their individual achievements.

(IN)SCRIBE Successfully Completes its Second Summer

The INdiana Summer Clinical Residency in Innovation for Biomedical Engineers, or (IN)SCRIBE Program, completed its second successful summer. Interns use team-based design to address unmet urban healthcare needs confronting Indiana’s healthcare challenges right at this source.

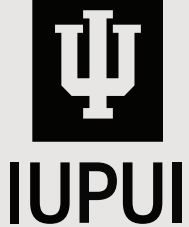
“After a week of design bootcamp, (IN)SCRIBE Scholars spent five one-week immersions in different Indianapolis hospitals. Students identified clinical user needs throughout while also reflecting on resource accessibility at each location. During the last week of (IN)SCRIBE, student teams propose a solution to one of the

clinical user needs identified from their immersion experiences.”

- Dr. Sharon Miller

(IN)SCRIBE’s Program Directors, Dr. Sharon Miller and Dr. Steve Higbee committed pursuants of discipline-based education research (DBER) in biomedical engineering. Dr. Miller and Dr. Higbee were excited to report an increase in student interns this year, jumping from 8 to 12. The BME Network is proud to recognize (IN)SCRIBE’s continued growth. With greater attention given to communicative advancement between disciplines, (IN)SCRIBE seeks to situate students for greater success in their professional endeavors.





BME Capstone Team Takes NIMDH Prize

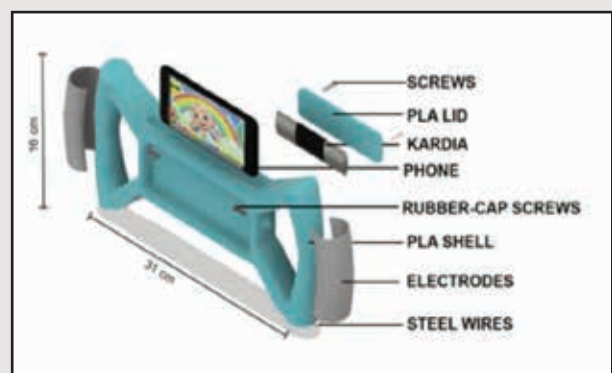
NIMHD Prize for Low-Resource Settings



The National Institute of Biomedical Imaging and Bioengineering (NIBIB) challenges undergraduate students to develop technology solutions to unmet needs in any area of healthcare. Last semester, our BME Capstone students (Joseph Bustamante, Nate Chesterson, Haley Gill, and Katie Murph) submitted their Research and Design to NIBIB's Design by Biomedical Undergraduate Teams (DEBUT) Challenge. The BME Network is proud to report our students won the NIMHD Prize for Low-Resource Settings with their "HappyHeart" design!

Their work was originally a product of our program's Research and Design Capstone project. The two-semester long senior capstone projects present their final prototypes and posters during this day, showing how far they've come as students in terms of content mastery, collaboration, and problem solving skills. In addition to capstone projects, the sophomore- and junior-level projects are presented and demonstrated for participants to see.

HappyHeart was a, "cost-effective innovative 3D-printed approach to pediatric diagnostic EKGs in clinical settings that will increase comfort, be easier to use, and reduce costs." Students across the nation submit proposals for the DEBUT Challenge. Our IUPUI students won alongside big name schools like Johns Hopkins and Cornell and even walked away with a \$1,000 cash prize! Congratulations guys!



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MESSAGE FROM THE
CHAIR**Joseph M. Wallace, PhD**Chair of the Department of Biomedical Engineering
and Professor of Biomedical Engineering


Twelve years ago, I arrived at IUPUI as a newly-minted Assistant Professor of Biomedical Engineering. I had stars in my eyes and was eager to take on whatever Academia had to throw my way. In January of 2020, I was given the opportunity to take on the role of Chair of BME. Nearly 3 years later, having navigated many unexpected and unforeseen challenges, accepting the position as Chair stands out as one of the best decisions I have ever made. I am grateful to the wonderful students, faculty, and staff in the BME department who have helped keep us on the path forward despite the many hurdles along the way. I look forward to what the future holds for BME at IUPUI.

The Indiana Commission for Higher Education approved our locally-administered PhD program in 2021, and I am happy to welcome 5 new students this fall, bringing our total to 8. It gives me great pride to see our graduate and undergraduate students taking advantage of the many wonderful opportunities our campus has to offer. We have seen countless journal publications, conference presentations, and funded grant proposals from our faculty members whose work would not be possible without students working hard in the lab. Recent

BME graduates have gone onto professional school at the IU School of Dentistry, Northwestern University Department of Prosthetics and Orthotics, and the MD/Ph.D program at Texas A&M. Others have secured positions at the IU School of Medicine, Eli Lilly and Company, Cook Medical, Medtronic, and more.

We are happy to welcome two new faculty into the fold! Lecturer Jennifer Hatch and Assistant Professor Dr. Rachel Surowiec are fantastic additions to our BME family. The hires were guided by our Department Enhancement Grant, funded internally as a part of IUPUI's NSF ADVANCE award back in '20-21. This grant has shed light on opportunities for our department to rethink how we recruit and retain talented faculty from groups that are underrepresented in engineering fields. This pursuit in particular has been a rich resource for critical reflection and department advancement. With this grant, we also established our BeingME Speaker Series. The goal of BeingME is to provide insightful talks from successful and inspiring individuals from diverse backgrounds in BME or related fields and we are excited to report that the seminar series will return for the '22-23 academic year with six new speakers! In fact, three of our speakers (Iman Yousif, Asad Raza, and Dr.

Sinead E. Miller) were former students of ours! Their successes highlight what our program has to offer. Their willingness to share their story with current students is a testament to their deeply personal connection to the Department of Biomedical Engineering at IUPUI. The summer of 2022 saw the second successful iteration of our INdiana Summer Clinical Residency in Innovation for Biomedical Engineers, or (IN)SCRIBE Program. Funded by the National Institutes of Health, (IN)SCRIBE is a 7-week clinical immersion experience for undergraduates that enables students to interact with medical professionals, learn from design faculty, and identify clinical issues in the Indianapolis health care system. We saw an increase from eight to twelve student participants in 2022. Our goal is to eventually extend this program to all BME undergraduate students.

Taken as a whole, after a time of such uncertainty, I would classify the first academic year back to in-person campus life as a success. Although there is still much to learn and do, it is safe to say we spent our time this past year intentionally and productively.





IUPUI

BeingME

SPEAKER SERIES

All Keynote Events in Innovation Hall (I05) at 1:30 pm

September 16, 2022

Dr. Whitney Gaskins

Assistant Dean and Assistant Professor
University of Cincinnati

Navigating Engineering Spaces as a Non-Traditional Academician

October 21, 2022

Asad Raza

Global Business Director
Johnson & Johnson Med-Tech, Robotics & Digital Solutions

How Can a Jack-of-All-Trades Become "The Master"?

BeingME Speaker Series Schedule

December 2, 2022

Dr. Aaron Kyle

Professor of the Practice in Biomedical Engineering
Duke University

A Different Path: On a Teaching-Focused Academic Career

January 20, 2023

Dr. Sinead E. Miller

CEO and Cofounder
PATH EX, Inc.

Becoming a Medical Device Entrepreneur: My Unexpected Journey

March 3, 2023

Iman Yousif

Team Lead, Design Assurance
Cook Medical

Creating Value for Yourself and Others

April 14, 2023

Dr. Danielle E. Soranno

Associate Professor, Department of Pediatrics
Indiana University School of Medicine

Engineering Better Health for Children

Scan to
Learn More!



This event was made possible through the IUPUI Project EPIC Department Enhancement Grant Program



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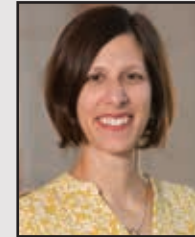
Sherry Clemens was the recipient of the **2022 Outstanding Staff Award**



This year, **Jennifer Hatch** will be joining our team as an **Lecturer**



Dr. Steven Higbee was promoted to the rank of **Clinical Associate Professor**



Dr. Sharon Miller received the 2022 **Trustees Teaching Award (TTA)**



Dr. Chien-Chi Lin was **awarded grants** from the **NIH** and **DoD PCARP** in support of his lab research



Dr. Joseph Wallace was **awarded grants** from the **NIH** and **VA** in support of his lab research



Dr. Hiroki Yokota was invited to speak on his work for the **Annual Meeting of Japan Orthopedic Society**



Dr. Ken Yoshida has had a massively successful year, including **publications, conference presentations**, and a **student with his lab earning the prestigious IUPUI Distinguished Master's Thesis Award** (Ivette Muzquiz, Awarded 11.2021)

Faculty Recognition

Student Awards

Outstanding BME Sophomores

Austin Chirgwin ('21)
Emily Hine ('21)
Chelsea Uyeno ('22)

Outstanding BME Juniors

Isaac Demaree ('21)
Anna Snider ('21)
Emily Hine ('22)
Isabelle Stanfield ('22)

Charles H. Turner Outstanding Academic Achievement for Senior Year

Collier Smith ('21), Isaac Demaree ('22), and Anna Snider ('22)

Outstanding Engineering Dual Degree Biomedical Engineering Student Award

Wushuang Yang ('21), Hannah Beaven ('22), and Josie Fieger ('22)

Exemplary Internship or Research Award

Timothy Hostetler ('21) and Katelyn Scott ('22)

BME Bepko Scholarships

Karan Bhula ('21 and '22)
Andrea Brunton ('22)
Austin Chirgwin ('22)
Kaylee Crowell ('21)
Yoselin Fonseca ('22)
Callie Kirksey ('22)
Charles Rumberger ('21)
Ruben Vizcarra Valdez ('21 and '22)

2022 Top 100 Students

Ishita Bhedi
Karan Bhula
Kaitlyn Colglazier
Isaac Demaree
Timothy Hostetler
Ashtin Wilson

2022 Top 10 Students

Andrea Jacobson

Biomedical Engineering Outstanding Service Award

Timothy Hostetler ('21) and Andrea Jacobson ('22)