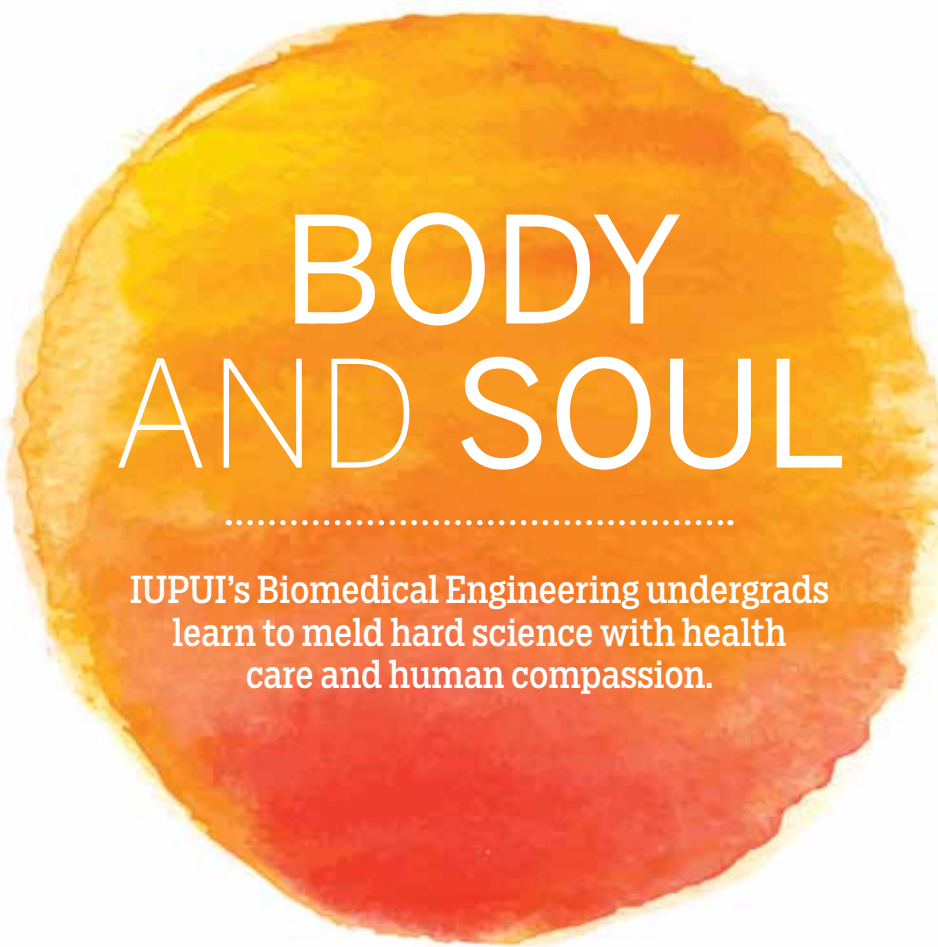




BODY AND SOUL

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**IUPUI's Biomedical Engineering undergrads
learn to meld hard science with health
care and human compassion.**

IUPUI senior Katie Wight, who's working toward a bachelor's degree in Biomedical Engineering, describes the Senior Design project on which she's collaborating as "pretty cool." But in fact it's designed to be anything *but* cool. Wight, along with a team composed of four other Biomedical Engineering seniors, is developing a device that could significantly improve the lives of newborns in sub-Saharan Africa – a solar-powered baby hammock/warmer.

Infant hypothermia is a big issue in this region. The problem inspired Wight and the rest of the team to design a "thermo regulator for neonates" – or, in layman's terms, a heated sling that monitors a child's temperature and provides auxiliary warmth when necessary. The battery-operated device can be charged by a solar panel, and will

be rugged enough to withstand rough treatment and require nothing more than diluted bleach solution for cleaning.

Creating such a system sounds like a tall order for anyone, let alone a group of busy college students. But Wight and her cohorts aren't like most students. The 22-year-old Fort Wayne native is an Adam W. Herbert Presidential Scholar, a member of IUPUI's Honors College, and formerly part of a virtual international research team focused on hip care and sponsored by the northern Indiana musculoskeletal health care company Zimmer Orthopaedic Products. So designing a piece of technology that could potentially save numberless young lives is just part of the program.

The Biomedical Engineering program, to be exact.

"That's the type of project I want to work on," Wight said. "Actually working with the body to improve the health of people. I love Biomedical Engineering and that's what I want to keep doing."

She's not alone in her desire. The program, begun in 2004, graduates approximately 35 students each year, some of them among the university's top academic performers. They're highly sought after by everyone from medical device companies to research centers.

"When I'm speaking with employers, I use a football analogy to describe the potential worth of these Biomedical Engineering students," said Ed Berbari, Ph.D., Professor of Medicine and Chair of Biomedical Engineering. "I tell them that you draft the best athlete, not the person who seems best for a given position. I tell them that the biomedical engineer is the best athlete, and by that I mean the smartest student. The one who's going to be able to solve a variety of problems for them – and they recognize that talent."

Biomedical Engineering is one of IUPUI's newest engineering departments, teaching such cutting-edge body/machine interfaces as orthopedic biomechanics, cardiovascular instrumentation, medical imaging, biomaterials, molecular engineering and tissue engineering. Put (very) simply, the field uses high technology to improve bodily function.

If one device sums up Biomedical Engineering, it's likely the cardiac pacemaker – a bundle of high-tech microprocessors embedded in the chest and charged with regulating the heart. It encompasses the many challenges



inherent in a field that combines such disparate tasks as Mechanical Engineering and healthcare.

What makes the work particularly challenging is that the human body absolutely hates having artificial devices placed inside it. Devices designed to do this have to be both highly sophisticated and extremely rugged.

The objectives of IUPUI's undergraduate Biomedical Engineering program are to integrate engineering and life sciences into a single curriculum that equips graduates to both meet those technical challenges and pursue myriad career paths. Those paths could include anything from working for medical device companies or life science-related industries, to pursuing advanced degrees in Biomedical Engineering, engineering or life sciences, to entering advanced programs in medicine, law, business or other areas.

Currently there are just north of 150 students enrolled in IUPUI's Biomedical Engineering undergraduate program. And the field is rapidly expanding. Nationally, the number of undergraduate programs has doubled in the last five years.

"I started as a graduate student in Biomedical Engineering in 1971," Berbari said. "At that time there were maybe half a dozen Biomedical Engineering programs. Today there are over 100 undergraduate Biomedical Engineering programs to choose from. They keep popping up."

Students begin their classwork by taking the same basic science and mathematics courses that all entry-

level engineers tackle. But they also add biology and additional physiology classes to their schedules.

"We train our students to look at problems in health care and life sciences so they can make contributions to fields such as the medical device industry," Berbari said. "That's probably the primary job market for our students, although they tend to go into places we don't expect."

They certainly do. Berbari says that Biomedical Engineering undergrads are among IUPUI's top academic performers, making graduates enticing to more than just medical device makers.

"Because we combine the traditional engineering background with a broader view of how to apply this skill to life sciences, the kind of student we attract tends to be very broadly interested," said Karen Alfrey, Ph.D., Associate Chair of Biomedical Engineering and Director of the Undergraduate Program.

"They don't just love one specific area. They love the math, the physics, the biology and the chemistry. And they're looking to use their skills in those areas in a way that directly benefits human health."

Because they're so broadly trained, graduates can pursue some very unexpected career paths.

"It's always fascinating to hear back from the alumni on what they're doing," Alfrey said. "Sometimes they'll find their way into jobs that we had not necessarily envisioned as something a traditional engineer might do. The people who employ them might not have considered engineers for those roles either, but having gotten them,

they realize their value and get very excited about recruiting more."

While all biomedical programs are inherently "hands on," the IUPUI program has a leg up when it comes to practical training.

"Because the IU School of Medicine is here, I often tell people that that's really our ace in the hole," Berbari said. "We have resources here for our students that are rather extraordinary, compared to the other engineering schools in our state that don't have that direct access."

Indeed, there are literally hundreds of opportunities at the IU School of Medicine for Biomedical Engineering students to participate in practical work. Alfrey recently asked participants in the junior-level class she teaches to raise their hands if they'd participated in some sort of internship, research or experiential learning through the programs offered by the department.

"Easily two-thirds of the students indicated that they've already done so," she said.

Steve Higbee, Ph.D., Lecturer and Coordinator for Undergraduate Research for IUPUI's Department of Biomedical Engineering, says the two biggest student-participation programs are the Life-Health Sciences Internship program (LHSI) and the Multidisciplinary Undergraduate Research Institute (MURI), which is run through the Center for Research and Learning at IUPUI.

"These are excellent training programs that are often first steps for students," Higbee said.



↑ Ed Berbari describes biomedical engineering as engineering for the body and for the health of mankind.

Participants in both programs receive a modest remuneration for their work – roughly \$1,500 per semester for LHSI and \$1,500 for the full academic year from MURI.

“It’s movie and pizza money,” Berbari said. “It rewards them for their efforts and it’s very much appreciated by the faculty sponsors to have the students feel that they get something out of it as well.”

The biggest project of every Biomedical Engineering undergrad’s career is undoubtedly the Senior Design course, the undergraduate program’s two-semester capstone. Each Senior Design class is broken up into five to seven teams (depending on class size) and works with faculty and corporate sponsors to develop a tool or product to meet a perceived need. Midwest Orthotics sponsors at least one team every year. IU School of Medicine labs also regularly participate.

Students are expected to offer up a “deliverable” – a working prototype of the device they set out to create.

“That’s a key aspect of the class, because it’s more of an engineering project than a science-based research project,” Berbari said. “It’s part of the accreditation process, and a requirement for the students to have this kind of experience.”

Those projects can range from a specialized piece of equipment for a particular lab to items with a larger scope. Such as, for instance, the solar-powered, computerized baby hammock that Wight’s team is working on.

Female engineering students like her are still a pronounced minority in most programs, but Berbari and Alfrey report that Biomedical Engineering attracts far more women.

“Of the engineering disciplines, Biomedical Engineering stands out as likely having the most female students,” Berbari said. “Female students may compose 5 to 10 percent on any typical engineering program. In Biomedical Engineering we’re at 30 to 35 percent.”

Alfrey chalks it up to the people-focused nature of the field, which she believes

attracts a different sort of student – both male and female. She thinks this because for years she’s asked students who take her own upper-level class to assess their own perceived strengths. The results seem somewhat unorthodox for a group of engineers, who are often stereotyped as caring more about machines than other humans.

“Having high achievement and high analytical skills comes up, which you would expect from engineers,” she said. “But they also tend to score higher on empathy and harmony – the sense of working with others to find solutions to problems.”

Wight says that’s the sort of attitude that drew her to the program. She’d been considering Chemical Engineering until she talked with Berbari.

“He described it to me as engineering for the body and for the health of mankind,” she said. “When I thought about it like that – that what I’d be working on would help the human body and make people’s lives better – that’s what really attracted me to Biomedical Engineering.”

That outlook, along with the eclectic training necessary to succeed in a field that combines the disparate realms of engineering and medicine, can make Biomedical Engineering graduates a hot commodity.

“Certainly because they are high-achieving and broadly educated, they’re doing a really good job of finding their niche once they go off into companies,” Alfrey said. ■