



BME NEWSLETTER



LETTER FROM THE CHAIR

JOHN SZIVEK, PH.D.



John Szivek

Dear BME GIDP Alumni, Students, Faculty, and Friends;

Although I have just begun to understand the framework that keeps the BME Program running smoothly, and have only had a short time to get to know all of the students and faculty, I do feel I have inherited a “teenager” from our past Chair, who skillfully guided the Program through the challenges of the “tween” years. Like any good parent, I would like to guide this Program safely into “adulthood”, while ensuring that the Program provides our students with as much stimulation, and as many choices as possible, to create their own paths. There will be a number of challenges, including the increasing size of the College of Engineering’s new Undergraduate Program, under the strong leadership of Dr. Jennifer Barton. Students

from that program will soon provide us with additional outstanding students, some of whom will undoubtedly want to enter our Graduate Program providing a challenge to all of the faculty to develop support for more and more high-quality students.

As I get to know our current students better, I am struck by the fact that they are excited about the future, and will work hard to pioneer new paths. I am lucky that the Biomedical Engineering field offers so many opportunities for students to explore, and that it offers lots of opportunities for innovation. This makes it easy for the Program to attract a stream of smart, ambitious, and dedicated applicants to BME. These students, like all of our current students, are the lifeblood of the Program. Without them the Program would not be possible.

As we enter the next year, I look forward to the next group of exceptional students, joining our ranks, to challenge current paradigms, and help our world-class faculty develop the technologies that will make all of our lives healthier and richer.

I wish you all a happy and productive year.

- JAS

BME Program Facts

- A 2011 report by The National Research Council ranks UA BME “between 4 and 33” out of all US bioengineering doctoral programs in Student Support and Outcomes (please visit www.nrc.arizona.edu for more details). Our BME Program was reported to be in the top 20% with such prestigious schools as UC Berkeley, MIT, Duke, and Johns Hopkins. In addition, a recent US News and World Report, on our Program, showed we admitted exceptional candidates, with the highest test scores to date.
- The U.S. Department of Labor projects that Biomedical Engineering will be the fastest-growing engineering discipline, in the next decade, and msn.com recently ranked it as the fastest growing occupation, from now until 2018.
- Our BME GIDP consists of faculty from 6 colleges and 17 departments.
- Since the BME GIDP was created in 1997, 29 doctoral and 29 master degrees have been awarded.

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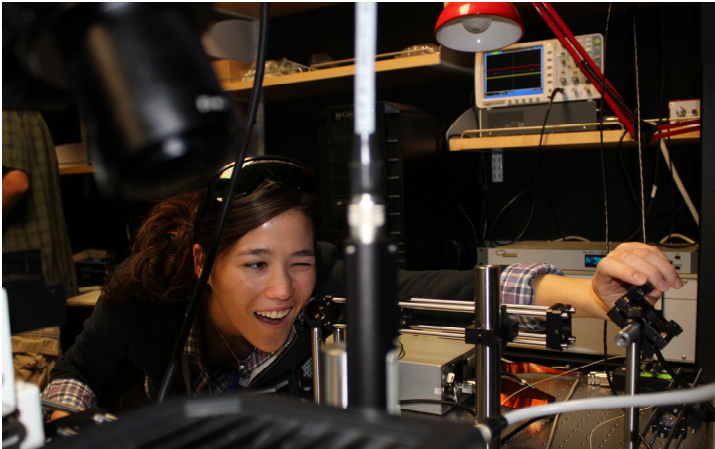
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Cacti in bloom, along the breezeway, between Keating and MRB.

PH.D. STUDENT INTERVIEW

SARAH LEUNG (FIFTH-YEAR PH.D. CANDIDATE)



Using her remaining good eye, Sarah aligns a component that directs a high-powered laser into her microscope setup for manipulating nanoparticles via optical trapping.

Sarah works in the Marek Romanowski lab developing novel nano-sized drug delivery vehicles. She will be defending her dissertation this May.

Tell us a bit about your research:

I work on gold-coated liposomes for two main applications. One is therapeutic—namely the use of gold-coated liposomes as a delivery vehicle for chemotherapeutics. By using this kind of approach, you can selectively target the drug to areas of interest, i.e. tumor cells, while avoiding delivery of the drug to healthy tissues. This means a high therapeutic dose in tumor tissues, therefore increasing drug efficacy, while reducing toxicity at healthy tissues. The second use is more of a platform technology for the research of cancer. We use gold-coated liposomes to selectively release a specific ligand of interest to locally perturb a cellular microenvironment. This can be used to study the cell signaling pathways that are responsible for the initiation and progression of cancer.

How did you become interested in Biomedical Engineering?

I chose bioengineering as my undergrad degree major. At the time, I was still looking at both engineering and medical school, and this fulfilled the requirements for both and it was something that sounded interesting.

How did you end up at The U of A for your PhD?

The more I learned about bioengineering, the more interested I became in continuing with it, rather than going into medical

school. I also did undergraduate research with Jay Hoying at The U of A. This early exposure to a research environment made me realize that the research and academic environment resonated with me and was something that I would want to go into. I also knew that there was research here that interested me. Other schools I was looking at seemed to have an emphasis on traditional bioengineering rather than the tissue engineering, drug delivery, and nanotechnology research areas that were serious interests of mine.

After earning your PhD, what's next?

I have no clue! And that's exciting, and worrying, at the same time. I have applied to both industry and academic positions, but which one I'll take? I have no idea.

Are there any aspects of being a grad student or The U of A that you will miss?

I'll definitely miss my mentor and my lab group. They were all very instrumental in shaping

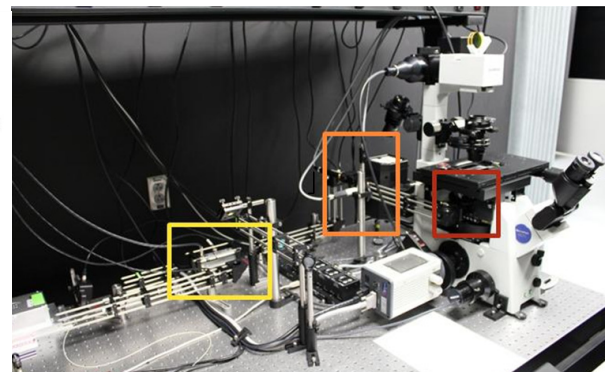
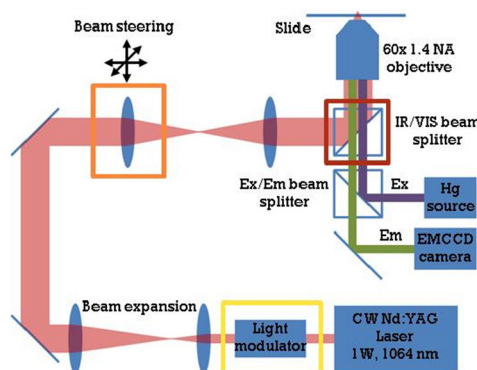
me as a researcher. I'll also miss the research environment at The U of A which is really collaborative - you really couldn't ask for more when you're a student trying to learn new techniques. I will also miss Tucson's 360 days of sunshine if I end up leaving - I love sunshine.

Any advice for current students in the program?

Always make the most of your situation. If you have the opportunity to travel or go to a conference, take it. If you have the opportunity to speak to other groups, take it. Taking on or doing more things usually works in the positive and you can always handle more than you think.

What do you do for fun outside the lab?

I love sports. Yoga is currently the object of my affection, although I'm also very into swimming and running. I also like movies. I haven't gone to a lot recently because I've been very busy. Anything that lets me calm down or unwind is always good. 🇺🇸



Layout for optical trapping of gold-coated liposomes. The continuous wave 1064 nm beam is modulated by a Pockels cell (yellow). After the beam expansion lenses, the beam passes through two beam steering lenses, the first of which is controlled in the xyz directions via piezoelectric motorized actuators (orange). The beam is then directed through a 60x 1.42 NA objective and to the sample by a VIS/IR dichroic mirror (red) that allows for simultaneous optical trapping and DIC and fluorescence microscopy.

MASTERS ALUMUS INTERVIEW JOE DEL ROSSI (M.S. '11)



Joe Del Rossi

Joe earned his BME MS in May 2011. He now works as a Mechanical Engineer for Baymar Solutions, a consulting/contract engineering firm whose largest client is Ventana Medical Systems.

What sort of work have you been doing since graduation?

After graduating, I spent a few months job-searching before landing this position. I really enjoy the work I am doing, because it mostly involves hands-on testing, in a lab environment, which is something I gained experience doing, while working towards my degree. We work primarily with the "Benchmark" line of instruments that Ventana designs and manufactures to perform ICH and ISH staining of tissue biopsies. Our team's job is to essentially update these instruments, and reduce the cost of production, by redesigning some of the parts. My primary role is to write and conduct testing protocols to validate the new parts that have already been re-designed. Because we have two to three different projects going on at the same time, the work never feels boring or repetitive. It's a very rewarding job, because I know that the instruments I am

helping improve are enabling pathologists to better treat patients with cancer.

How has the transition to the 'real world' been?

I can't complain about the "real world." The transition has been pretty smooth. It's nice finally having money and not living on a limited budget of loans anymore, but I do miss making my own class schedule and long holiday breaks. The best part now is not always having that feeling that something is due, a test/project is on the horizon, or I need to get homework done. It took a while to get used to the notion that once I get home from work, the rest of the day is mine. I would definitely have to say that work-life is less fun, but a whole lot less stressful than being in school.

How did you become interested in Biomedical Engineering?

All throughout grade school and high school I've always been interested in science and medicine. For some time I con-



A Benchmark Ultra, stained tissue samples, and vortex mixers. Vortex mixers blow air in opposing directions, creating a vortex pattern that keeps reagents well-mixed on the surface of the slide.

sidered medical school, but ultimately decided that path wasn't for me. I love designing, building, and testing, so I felt naturally drawn towards engineering. During my senior year in high school, we were required to shadow a professional, in the field we were most interested in. My uncle was the only engineer I knew, and happened to be a Biomedical Engineer. It was a great experience, so my interest in medical devices and equipment only grew from that point.

Why did you choose U of A?

At the time, when I was finishing up high school, in Delaware, my family already had plans to move to Las Vegas, so my college search was directed towards the West Coast. We made one long trip to visit a few schools in California, then ASU and U of A. Other than a respected engineering program, I was looking for a school where I could continue to play ice hockey, at a competitive level. I didn't find what I was looking for from the schools in California. Both ASU and U of A have Division 1 club ice hockey teams, but I found the campus atmosphere of U of A to be the nicest of any school I visited. It was an easy decision to come here, over ASU.

What was your research focus when you were here?

I chose to research with Dr. Xiaoyi Wu, after completing a lab rotation in his tissue engineering/biomechanics lab. For my masters research, I worked with a process called electrospraying, to create drug delivery nanoparticles. My goal was to load Doxorubicin (anti-cancer drug) into the core of

Cerasomes (hybrid of liposome with ceramic shell), then fine-tune the parameters of the electrospray process to produce stable particles of approximately 200 nm. Being in the Accelerated Masters Program meant I only had two semesters to do research, but, in that time, I was able to achieve what we had set out to. Dr. Wu was a terrific mentor, because he guided me along while still challenging me to figure things out for myself. I am very thankful for the opportunity and knowledge gained through working with him.

Do you have any good memories from UA/BME/Tucson?

I have so many great memories from the UofA and BME that it's hard to just pick a few. From the UofA, I would definitely choose my memories of playing for the Icecats. Playing in front of thousands of fans, at the TCC, and getting to travel all over the country, with my team, is something I'll never forget. From BME, both winning the Builders' Day Poster Presentation, and successfully completing my Master's Defense, stand out as exciting and memorable moments for me.

When you're not working, what do you do for fun?

My newest favorite hobby is playing golf. I used to play occasionally, when I was younger, but recently took a much stronger interest in becoming better. I've found that golfing is also a hobby of most of my co-workers, so it's nice to be able to go out with some people, from work, and not make a fool of myself. ❌

PH.D. ALUMNUS INTERVIEW PATRICK MARCUS (PH.D. '06)



Patrick Marcus

Patrick earned his BME Ph.D. in 2006 and is currently the President of Marcus Engineering, LLC, an advanced technological design services company here in Tucson. Projects includes Embedded Systems Design, PCB Layout, Product Development, Analog and Power Electronics design, and Industrial Controls and Automation. Please visit marcusengineering.com for more information.

What sort of work have you been doing since graduation?

Lots of things—Electronics Design, Management, Entrepreneurship, Business Development, Marketing, Solar, Medical Devices, Power Electronics, Art, Teaching.

How was the transition from graduate school to the 'real world'?

The transition was seamless. The key though, was having worked in the real world be-

fore, and doing so during school.

How did you become interested in Biomedical Engineering? Why did you choose UA?

I had originally planned to attend medical school with an emphasis on medical research. After discovering that many of the medical doctors that I knew were very unhappy, I decided to go a different route. I chose U of A because I wanted to stay in Tucson and believed I could have just as good of an education here as anywhere.

Who was your mentor at UA? What was your research focus?

I worked with Andrew Fuglevand, in Neuroprosthetics.

Are there any specific aspects of the BME Program that have been beneficial to your career?

Yes, the interdisciplinary breadth that was available was tremendous. I would not have been as successful as I am had I not had the freedom to explore engineering, medicine, entrepreneurship, and business without the encouragement of the Program.

What good memories and experiences do you have from UA/BME/Tucson?

U of A has a beautiful campus, and Tucson is a great low key

place to live. After a hard day, it is always easy to wander outside and sit in the grass to relax. Rarely is there a day when a stroll across the sunny mall doesn't feel pretty darn good.

Do you have any hobbies? When you're not working, what do you do for fun?

For fun, I teach Senior Design for the College of Engineering,

build and design New Media Solar Art (<http://www.solarsculptures.com>), and volunteer time to local industry clusters and associations, such as the Arizona Bio-industry Association, Bioscience Leadership Council, Arizona Optics Industry Association, Arizona Technology Council, and Southern Arizona Leadership Council. ✂



Patrick in front of *Skyburst 2*, a public art sculpture for which he designed and built the electronics, and wrote the software. This piece is installed in the inner courtyard of Plaza Colonial, located at the corner of Campbell Ave and Skyline Dr. His latest public art project is an installation at Tucson Airport (more details at www.solarsculptures.com/?p=316).

BME FACULTY INTERVIEW URS UTZINGER, PH.D.



Urs Utzinger and Animal

Dr. Utzinger has been faculty at The UA since 2001 in Biomedical Engineering, Optical Sciences, Electrical and Computer Engineering, and Obstetrics & Gynecology.

Can you provide a little background on yourself?

I grew up in a small town outside of Zurich. The most important deciding factor in being where I am today is that a high school opened close to my home town, which was rare because in Switzerland only ~20% of the kids go to high school. The others go through something similar to community college and then onto an apprenticeship. With this school opening nearby, it was possible for me to attend because it was easy access. In Zurich there's the University of Zurich and the Swiss Federal Institute of Technology (ETH) which is a federal institute, so it's like a national lab. It's a pretty good institution as they usually claim a few Nobel Laureates. But at that time I didn't know and I didn't care because I wanted to become an engineer and that's what you did! I didn't know which kind but I knew I would be an engineer, and ETH was the closest school to my home town. So it all hap-

pened by chance – the high school opened at the right time for me to attend and then I just went to the closest university. It was a great school with lots of resources. There was no such thing as an undergrad – you either got a Master's Degree or got a Master's and continued for a PhD. And usually when you're working on your PhD, you don't take classes anymore, you just work on research and write your dissertation – about 4 years. I was there about 8 or 9 years total. Also, a lot of Swiss guys have to do their mandatory military service in between, consisting of 17 weeks of basic training. I learned how to throw a grenade, operate a rocket launcher and an automatic rifle – I hated it! My kids are like, 'Oh, cool!' But no, it was not – it was just a pain. No fun.

How did you end up in Biomedical Engineering?

So at my time, Biomedical Engineering was considered some kind of appendix to classical engineering disciplines, like mechanical or electrical. To me, it was a decision about which of the traditional engineering directions I wanted to go: computers, electrical, mechanical, or material sciences. I just chose the one that's most natural and that was mechanical. Within those different departments, they each had a track for biomedical engineering. So I got a degree in mechanical engineering, but my specialty was in biomedical engineering. That had the advantage of being the broadest, and I felt, the most interesting of all, because it had everything – including life sciences and working with physicians. Similar to here, the university hospital was just next door.

How did you get from your PhD to where you are today?

A faculty from Austin, TX came for his sabbatical to the French part of Switzerland, and he was a tissue optics guy. I already worked in a laser lab that was interested in that was interested in laser light interaction with tissue. This faculty gave lectures as part of his sabbatical, so to go hear his lectures, we would take a train 2 - 3 hours. This was towards the end of my PhD studies and because I was looking for a post-doctoral place to go, I contacted him.

What is the focus of your lab's research?

Everything I work with involves light, but I would divide my work into clinical applications, and more basic science applications. The new clinical applications project, that I recently started to work on, is a collaboration with Bhaskar Banerjee, MD, Head of Gastroenterology. These are the people that do colonoscopies, colon screening and are also involved with pancreatic cancer and bile ducts. The main clinical issue is that during colonoscopies, flat lesions or small lesions are often missed. While it is possible to develop molecular contrast agents that could be sprayed on the colon to cause these hard-to-detect lesions light up, this method is unlikely to be adopted by physicians – currently it takes a physician only about 6 minutes to perform a colonoscopy. If you want to spray the colon surface with a contrast agent, incubate, and wash, it would take longer, so it's not likely that contrast agent techniques will be used in the colon. Our project's goal is to see if there is naturally exist-

ing contrast in the colon that we could exploit. So far, it looks like with some strange combinations of wavelengths of light and multiplying and dividing imaging (we call this formulaic imaging) we can produce quite a bit of contrast. But it actually turns out that it's also difficult to see, with this method, but it still might be better for seeing the colorless flat lesions—the ones most likely to develop into cancer.

On the laboratory side, I do quite a bit of work with microscopy, studying the growth of blood vessels. This angiogenesis project is a collaboration with previous faculty that were here. The main issue is to see how the growth of blood vessels affects the mechanical properties of the extracellular matrix (ECM), and how the mechanical properties of the ECM affect vessel growth. I provide the imaging aspect of the project. We've seen vessels make 180 degree turns and going backwards – it's pretty crazy when they do this!

What do you like best about your position?

Money was never a really important factor, in my career decisions. I mean, I have a degree that gives me the sufficient resources to live the way I more or less want to live. But, going into industry, and having all of my work owned by somebody else, and having somebody else making a decision to shoot down work that I've maybe spent years on, would be hard to imagine. What's so exciting, in academia, is that if you don't do well, it's really your own problem, and if you do well, it's really you that has done it. Also if the students do well, somehow, it reflects a

BME FACULTY INTERVIEW, CONTINUED URS UTZINGER, PH.D.

little back, too. You can easily take ownership of your success, and success of other people you've been working with, during that time. It just matters how you think about things. So on one side you have more responsibility, and more to sweat about, but on the other side, if things go well, and you have a success, nobody comes and takes it away.

What do you do for fun outside of the lab?


Unfortunately, I do spend a lot of time here in the lab. I have four kids, and last year was the first time I took on a larger project, with them, just because of the fun of it. That's when we built the pumpkin toss machine. I spent every weekend, for several months, using most of my free time putting this machine together, just for the heck of it and being able to say I did it. When you throw that

thing, and even if it's just 50 or 100 people watching and they're all impressed, it's just like playing a guitar at a rock concert! This was a fun thing. It's not renovating a bathroom, it's not fixing the car, it's not fixing the house, it's just for

fun. Nothing coming out of it beside fun!

Do you have any advice for current or past students?

Students should make sure they stay connected with their mentors, former mentors, or department heads. To us it's

interesting and important to see what our students end up doing. Even if a student is not in my lab, but has taken one of my courses, and one day has a big success, I feel really good about myself, because I feel like I may have contributed a tiny little bit to that success. 



Urs assembling his famous Pumpkin Toss Machine on The UA Mall last fall.



BIOMEDICAL ENGINEERING GRADUATE INTERDISCIPLINARY PROGRAM

INFORMATION



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Phat Tran (BME PhD '11), Sarah Leung and Urs Utzinger play volleyball at the 2011 BME Fall Picnic.