From the Chair’s Desk –
- Zhiqiang Mao

Tulane University’s Physics and Engineering Physics (PEP) Department is undergoing a major expansion in the area of materials science and engineering, a field that is both as old as human civilization and a critical focus area for 21st century technological advancement. Five faculty members with a materials science and engineering background have been recruited to the department in the past three years: Profs. Doug Chrissey, Diyar Talbayev, Jiang Wei, Matthew Escarra, and Noa Marom. These are all outstanding hires. Dr. Chrissey was hired as an endowed chair professor and his research interest is energy and biological materials. The other four are junior hires and they all have very strong track records in research. Dr. Talbayev (PhD from Stony Brook Univ., postdoc at Los Alamos National Lab and Yale) joined us in 2011 and his expertise is optical spectroscopy. Dr. Wei came to Tulane in 2012 (PhD from Univ. of Washington-Seattle, postdoc at Rice Univ.) and his research focuses on nanostructured quantum devices. Dr. Escarra (PhD from Princeton Univ., postdoc at Caltech) and Dr. Marom (PhD from Weizmann Institute of Science in Israel and postdoc at Univ. of Texas at Austin) were hired just last fall. Dr. Escarra’s research interest is photonic materials and devices, while Dr. Marom’s expertise is computational materials science. The department has considered the synergy among these new hires, i.e., the integration of fundamental materials science and materials engineering.

The department plans to add a new PhD program in materials science and engineering (MSE) in the near future. Moreover, the infrastructure for materials research at Tulane has been significantly improved. A cleanroom facility with nanofabrication capability in Stanley Thomas (ST) Hall has been established and most of the space on the first two floors of ST has been made available for the development of the materials program. Advanced materials are considered to be critical to economic growth and global competitiveness in the 21st century. One of the goals proposed in PEP’s strategic plan is to establish a competitive research team in materials science and engineering. This team will have unique combined expertise, ranging from materials theory and computational modeling (Noa Marom), to material synthesis and characterization (Zhiqiang Mao and Diyar Talbayev), to new device exploration and material processing and applications (Jiang Wei, Matt Escarra, and Doug Chrissey). This team could be the core of a future materials research institute and aims at developing novel materials with unique properties which could lead to significant advancement in nanoelectronics, optoelectronics, and other energy-related technologies.

Moreover, PEP continues to have a strong research program in polymer physics led by Prof. Wayne Reed. Prof. Reed has done exemplary work in integrating fundamental research in polymer physics with applications. He is the founder of the Tulane Center for Polymer Reaction Monitoring and Characterization (PolyRMC), which has established strong partnerships with industry, and in 2012 launched a spin-off company, APMT. While we are focusing on MSE, we also plan to maintain breadth in physics research and expand into other research areas. For example, we have strong research programs in quantum chaos and quantum information (Prof. Lev Kaplan) and in experimental nuclear physics (Prof. Fred Wietfeldt). We are currently conducting a search for two junior faculty positions (one experimental and the other theoretical).
This has been another good year for our academic programs. In 2013-2014, Engineering Physics went through a demanding re-accreditation review process by ABET’s Engineering Accreditation Commission, alongside Tulane’s other engineering programs. Although the official re-accreditation decisions will not be announced until late summer, we fully expect a positive outcome based on the results of the site visit. The ABET visitor was particularly impressed by the active involvement of our advisory board (as reflected for example by board members’ participation in the departmental retreat), by our graduates’ high success rate on the Fundamentals of Engineering exam (the first step towards becoming a professional engineer) and by our graduates’ educational and job paths. Many of our May 2013 graduates headed to grad schools such as Columbia, Rice, UC Boulder, and Tulane, while others obtained engineering industry positions with excellent companies including GM and Delphi Automotive. And the brand new student lab in Stanley Thomas Hall, in close proximity to faculty offices and research lab space, certainly did not hurt! The Physics PhD program has recently been strengthened, guided in part by a helpful external review report received last year. The changes build on our existing guidelines and should enable even more of our graduate students to transition early into full-time research and to stay on track to earn the PhD on schedule.

Our course offerings at all levels continued to expand this year. Additions to the catalog range from “Elementary Particle Physics,” which was previously taught by Prof. Fred Wietfeldt as a special topics course (and received rave reviews from students), to “Kinetics of Material Systems” and “Structure of Materials,” both of which are being taught by Prof. Doug Chrisey and form a key part of the foundation for the proposed exciting new graduate program in Materials Science and Engineering. All three courses are cross-listed so that both graduate and undergraduate students can take advantage of these offerings.

Professor Jerry Shakov introduced a new “Physics for Architects” course, so that for the first time all Tulane Architecture students will learn the physics they need to be successful in their chosen profession. Prof. Shakov is teaching the class in an innovative “flipped classroom” format, which allows for extensive discussion and problem solving during class time. By popular demand, Prof. Schuler is teaching for the first time an undergraduate special topics course on “Microcontrollers.” Last but not least, the new “Materials Camp” for motivated high school students brought 24 students to Tulane’s campus last summer. This two-week intensive course, which was co-taught by five faculty and several graduate students proved to be a success, and will be offered again this summer in an expanded format.

As always, we are eager to hear from you with suggestions on how to continue to improve the educational experience of our students in PEP. We are also updating and expanding our departmental website tulane.edu/sse/pep/ to make it more valuable both for Tulanians and for future Tulanians (from applying students to prospective new faculty), and we welcome your ideas. The easiest way to contact me is by email at lkaplan@tulane.edu though of course you are always welcome to visit me in the new office in Stanley Thomas Hall.
**Promotions—**

Wayne F. Reed, founder of the Center for Polymer Reaction Monitoring and Characterization at Tulane University, was invested as the second holder of the Murchison-Mallory Chair in Physics at the Tulane School of Science and Engineering on Nov. 22, 2013.

In 2007, Prof. Reed started the nonprofit research and development center, which is devoted to polymerization reaction monitoring. The center has quickly become the global leader in its highly focused but widely applicable field. Reed recently established a spin-off company, Advanced Polymer Monitoring Technologies, which gives industry experience to students through internships and design projects.

The Murchison-Mallory Chair in Physics was established by a gift from Dr. Meredith “Ace” Mallory in honor of his late wife, Patricia Ann Murchison. Mallory earned a medical degree from Tulane in 1944. A doctor, businessman, scientist, philanthropist and lifelong family man, Mallory’s love for his alma mater was apparent throughout his lifetime.

At the ceremony, provost Michael Bernstein said, “I feel honored to celebrate Wayne in this very important moment in his career. The awarding of an endowed chair is the recognition of an excellent career and remarkable accomplishments.”

Reed joined the Tulane physics faculty in 1985 after completing his doctoral degree in physics at Clarkson University. At Tulane, Reed’s research has concentrated on experimental macromolecular and colloid science with a particular focus on electrically charged polymers or polyelectrolytes. Reed’s work has appeared in numerous publications, was the subject of presentations at international conferences and is supported by numerous federal and state grants. His research has led to several patents that have been licensed by the private sector.

At the ceremony, Reed described his current research activities and discussed the future of scientific innovation and applications.

“I am so grateful to work at Tulane. The institution is upholding the true meaning of academic freedom,” Reed said.

**Lev Kaplan was promoted to Full Professor**

We congratulate Prof. Lev Kaplan on his promotion to Full Professor last year. Prof. Kaplan earned his PhD in particle theory from Harvard University, and subsequently held positions as a Junior Fellow at Harvard’s Society of Fellows and as an Institute for Nuclear Theory Junior Fellow at the University of Washington prior to joining our faculty in 2003. Prof. Kaplan’s research group currently includes undergraduate student Robert Kramer, PhD students Sicong Chen, Jake Smith, and Yang Zhang, and Adjunct Professor Basil Davis. His recent research, sponsored in large part by the National Science Foundation, ranges from quantum chaos to rogue ocean waves, from quantum information to vacuum energy, and from superradiance in biological systems to twisted light.
Prof. Kaplan has taught a wide variety of courses at Tulane including two that he developed here: “Computational Physics and Engineering” and “Quantum Information Physics and Engineering”, and has earned awards for both undergraduate and graduate teaching at Tulane. In addition to serving as Associate Chair for Academics, he advises Engineering Physics majors and dual-degree physics+engineering students (with Johns Hopkins or Vanderbilt) in our department.

**Timothy Schuler was promoted to Senior Professor of Practice**

Dr. Schuler has been with the Physics and Engineering Physics Department since 2006. He received his Ph.D. from Tulane, studying experimental solid-state physics under Dr. David Ederer. Prior to coming to Tulane he was employed as a Senior Research Engineer at Mississippi Polymer Technologies (now Solvay Adv. Polymers). His main focus is laboratory education and hands-on programs. He is an inveterate tinkerer in his spare time.

By student request, Dr. Schuler has developed a new Engineering Physics (ENGP) course in Microcontrollers, with the goal of introducing students to the hardware and software development of utilizing these devices with modern sensors and motors. The course covers the basics of Arduino, Raspberry Pi, and Beaglebone microcontroller systems and programming in Processing, Java, and Python languages. The course is currently being taught for the first time and is at capacity.

In Fall 2013 Dr. Schuler was awarded a grant from the Center for Engaged Learning and Teaching (CELT) for Faculty-Student Scholarly and Artistic Engagement for academic year 2013-14. This allowed him to oversee a senior design project for two ENGP students designing and implementing a low-cost, open source solution for underfunded schools wishing to use electronic sensors in their physics labs. The project is built around inexpensive microcontrollers and off-the-shelf sensors coupled with data collection programs that are not only free but also able to be personalized by any teacher or student who wishes. He hopes to further expand this program in the future.

Over the past year Dr. Schuler has continued to work on developing new laboratory equipment and experiments for first-year students. The intent is to open up the lab course to more student inquiry and move away from “cook book” experiments. These new instructions force the students to make their own decisions regarding performing experiments, in some cases requiring them to design their own experiments from scratch to solve a specific problem. During a 10-week summer internship, four Tulane students worked with Dr. Schuler to create about a dozen new experiments, which are now being implemented into the lab courses.

Dr. Schuler has also been working with representatives from the Biomedical Engineering Department to develop a plan for cleaning up the machine shop for student use. The space will be re-organized to create a more useful workshop, remove unused tools and equipment, strengthen safety protocols, and figure out a means for staffing such a space for undergraduate use. In the future, new machines and tools will be added and the workspace will be further improved.

As a hobby, Dr. Schuler designs amplifiers/speakers for cell phone audio in various found objects including cigar boxes and ammunition cans. His devices are sold at the Ariodante Contemporary Craft Gallery, where he was recently a featured artist on a month-long show.
Awards –

Skylar Deckoff-Jones Was awarded the 2014 Goldwater Scholarship

Skylar feels very fortunate to have been able to get research experience early in his academic career. After graduating high school, he spent the summer as a student intern at Los Alamos National Laboratory. This was his first experience in a research environment and by the end of the summer he knew he wanted more. At Tulane, he has been working in Prof. Diyar Talbayev’s group for the past year and a half. Skylar is continually amazed and inspired by the material characterization research he has been participating in. He is looking forward to spending the summer at Okinawa Institute of Science and Technology, where he will conduct femtosecond spectroscopy research. He feels honored by the awards and opportunities bestowed on him, and is excited for what the future holds.

John Elliott Ortmann was awarded the Joseph J. Kyame Physics Award and an NSF Graduate Research Fellowship (at UT Austin)

Elliott is an excellent student with a 3.95 GPA and an outstanding record in his coursework. His performance in research is exceptional. His work on “Competition between Antiferromagnetism and Ferromagnetism in Sr$_2$RuO$_4$ Probed by Mn and Co Doping” was recently published in Scientific Reports. He presented his research results to an enthusiastic audience at the 2013 American Physical Society March Meeting.

Elizabeth Mae Scott was awarded the Elsie Field Dupré Memorial Prize in Physics for a Female Undergraduate

Mae typifies the best of Tulane's undergraduates, earning a cumulative GPA of 3.81. She is admired by teachers and fellow students for her engaging and conscientious nature and intellectual curiosity. In 2012, she was selected for a prestigious summer fellowship at the NIST Center for Neutron Research in Maryland where she performed sophisticated computational analyses of a novel neutron detector. This was also the basis of her senior honors thesis. She is now in the Ph.D. program at the University of Tennessee to study neutron science and conduct research at the Spallation Neutron Source.

New faces in the Department –

Prof. Noa Marom joined the Physics and Engineering Physics department in Fall 2013, as an Assistant Professor. Prof. Marom received her doctorate in 2010 from the Weizmann Institute of Science in her home country of Israel. She was awarded the Shimon Reich Memorial Prize of Excellence for her thesis on describing the electronic structure of organic semiconductors from first principles. She
then pursued postdoctoral research at the Institute for Computational Engineering and Sciences (IC-ES) at the University of Texas at Austin. Prof. Marom’s field of research is computational materials science. Inspired by the vision of computational materials design, her group uses supercomputers to perform quantum-mechanical simulations of crystals, molecules, atomic clusters, interfaces, and complex nanostructures. In particular, the Marom group is interested in the structure and electronic properties of organic—inorganic interfaces, found in organic and dye-sensitized solar cells, and in van der Waals interactions in molecular crystals and other weakly bound systems. The group currently includes graduate research assistant Farren Curtis and undergraduate research assistants Chris Jumonville and Ben Sonin. Students interested in joining the group are invited to contact Prof. Marom: nmarom@tulane.edu

Welcome our new 2013 graduate students:
Christina DeAngelis, Robert Haun, Kate Hefternan, Sijun Luo, Adam Ollanik, Brooke Peadan, John Robertson, Joshua Shipman, Samuel Sklare

Faculty News –

Prof. Wayne Reed’s Center for Polymer Reaction Monitoring and Characterization (PolyRMC) hired Dr. Curtis Jarand as Sr. Instrumentation Specialist. Prof. Scott Grayson (Tulane Chemistry Dept.) was added as a faculty affiliate of PolyRMC. Carl Pasquarelli, the Nalco Plant Manager in Garyville, Louisiana, joined the PolyRMC Advisory Board. PolyRMC organized the 26th International Symposium on Polymer Analysis and Characterization (ISPAC) in June 2013 at the Hotel Monteleone. The 4-day event attracted over 150 industry and academic scientists from all over the world. PolyRMC’s spin-off company Advanced Polymer Monitoring Technologies, Inc. (APMT) was awarded a Phase I SBIR award to research PolyRMC’s Simultaneous Multiple Sample Light Scattering (SMSLS) technology in collaboration with Prof. Anne Robinson in the Tulane Chemical and Biomolecular Engineering department. PolyRMC continued its Engineering Physics internship and senior design program in conjunction with APMT. Interns at PolyRMC and APMT worked side by side over summer 2013. PEP seniors Colin Howell, Ryan Swinney and Nick Chvany are currently working on senior design projects with PolyRMC. PolyRMC’s Profs. Alina Alb and Wayne Reed edited a book published by Wiley in January 2014. The book, Monitoring Polymerization Reactions: From Fundamentals to Applications, is highly interdisciplinary and includes contributions from over two dozen scientists in fields spanning Physics, Chemistry, Chemical and Mechanical Engineering, Biotechnology, and Pharmaceutical Science, and thus aims to provide a comprehensive review of polymerization fundamentals and methodologies, characterization methods, and their applicability at industrial scale.
Prof. Diyar Talbayev’s Femtosecond & Terahertz Spectroscopy Laboratory now includes PhD students Punam Silwal and Kate Heffernan and sophomore Skylar Deckoff-Jones. Punam Silwal holds a Research Assistantship supported by a grant from the Louisiana Board of Regents Research Competitiveness Subprogram. For the project titled “Terahertz time-domain ellipsometry: probing collective modes and itinerant electrons in complex functional materials,” Punam is working on the high-field terahertz spectroscopy of the magnetic ferroelectric BiFeO₃. High-field Terahertz spectroscopy probes a material’s response to the intense Terahertz electric field of 100s of kV/cm in amplitude. The aim of this work is the coherent manipulation and control of magnetic and ferroelectric orders in BiFeO₃. To develop the high-field Terahertz studies of BiFeO₃ and other magnetic ferroelectrics, Prof. Talbayev recently received a research grant from the Louisiana EP-SCoR program Pilot Funding for New Research (PFund). Kate Heffernan is developing a new experimental tool – near-field THz microspectroscopy. Her goal is to measure the THz optical properties of 2D atomically-layered materials prepared by mechanical exfoliation, such as iron chalcogenide superconductors and ternary transition metal chalcogenides. Skylar Deckoff-Jones is working on implementing low-temperature THz time-domain ellipsometry for studies of superconductors. His research is supported by a grant from the CELT Fund for Faculty/Student Scholarly and Artistic Engagement. Skylar has been working in the group since his arrival at Tulane as a freshman. He was recently selected to participate in the NanoJapan IREU in Summer 2014. Skylar was one of 12 students out of 149 applicants chosen for the program run by the Rice Quantum Institute in partnership with leading research institutions in Japan. Notable group publications in the past year include the study of spin waves in BiFeO₃ in high magnetic field [Physical Review Letters 110, 25720 (2013)] and the optical pump-probe study of the interplay between quantum charge and spin fluctuations in multiferroic LuFe₂O₄ [Scientific Reports 3, 2654 (2013)].

Prof. Fred Wietfeldt’s Neutron Physics Group continues its research on precision neutron decay measurements and neutron interferometry at the NIST Center for Neutron Research (NCNR) in Gaithersburg, Maryland. The "a" Correlation in Neutron decay (aCORN) experiment, a large collaboration led by Fred Wietfeldt as the PI and spokesman, and with Tulane as the lead institution, continues to run at the NCNR. It is collecting data that will make the world's best measurement of the electron-neutrino correlation in free neutron decay, an important parameter for understanding the weak nuclear force. At its February 2014 meeting the NCNR Beamtime Allocation Committee chose aCORN to be the first experiment to run at the new high-flux neutron beam NG-C (part of the $100M NCNR expansion project). The experiment will move to the new beam this summer and run for one year.

The group, along with NIST collaborators, completed a high precision absolute calibration of the neutron counter used to measure the neutron beta decay lifetime. It led to a significant shift in the value of the neutron lifetime, to 887.7 ± 2.2 s. This result was recently published in the Nov. 27, 2013 issue of Physical Review Letters.

Graduate students Tauifique Hassan and Chandra Shahi continue to work at the NCNR full time and are nearing completion of their Ph.D. research. Postdoc Guillaume Darius will leave the group in July and return to teach in France – he has been an outstanding asset and we’ll miss him very much.

We welcome new first year graduate students Christina DeAngelis and Robert Haun to the group.
A Materials Boom at Tulane –

Tulane University’s Physics and Engineering Physics (PEP) Department is undergoing a major expansion in the area of materials science and engineering, a field that is both as old as human civilization and a critical focus area for 21st century technological advancement. The department has a recent history of strength in this area, and the focused growth in faculty, research, educational programs, and infrastructure is designed to make Tulane’s program an internationally recognized center of excellence.

In the last three years alone, Tulane has hired five new faculty in the PEP department with expertise in materials science and engineering. At the senior level, Prof. Doug Chrisey, the Jung Chair of Materials Engineering, started in Fall 2012 and is leading this effort. His research focuses on energy materials and biomaterials. He is currently publishing in areas of metallic nanoparticle fabrication, biosensing, bionanotechnology, tissue engineering, stem cell processing, ceramics, and polyamorphism.

Four assistant professors have also been hired in the last three years. Prof. Diyar Talbayev started in 2011 and focuses on optical spectroscopy of complex materials. Prof. Jiang Wei started in 2012, and his laboratory studies electronic nano-devices based on novel materials. Prof. Matthew Escarra started in 2013, and his laboratory develops photonic materials and devices, with a focus on solar energy and light-emitters with improved and novel properties. Prof. Noa Marom also started in 2013, and her research focus is on computational materials science.

This influx of new faculty and expertise is fueling the highly successful, ABET-accredited Engineering Physics undergraduate program, which began in 2007. At the graduate level, a new Materials Science and Engineering PhD program is anticipated to launch in the near future. Furthermore, programs are under development that would offer a professional and/or part-time masters level education in materials science and engineering.

The success of this materials program is due in part to a significant investment in new facilities to support these research and educational endeavors. Tulane has established a shared instrumentation facility for the synthesis and study of new materials and related devices at the micro and nanoscale (see photo). This facility features a major

The new Engineering Physics Lab and student lounge in Stanley Thomas Hall

Right: an Engineering Physics design project with a local flavor

Bottom: a student working in the cleanroom facility
cleanroom space equipped with tools for highly controlled material patterning, deposition, removal, and characterization. In addition to this cleanroom facility, all of the new experimental faculty have developed leading-edge laboratories to carry out their scientific programs. Sizable new investments in computational resources at Tulane are also supporting these programs. This center will not only benefit current and future students, faculty, and researchers at Tulane, but it will also be a major asset for the city and region. While the New Orleans regional economy is growing at a steady pace, there is a tremendous need for skilled workers to fuel this growth, particularly in the high tech and manufacturing sectors. Tulane’s Engineering Physics and Materials Science and Engineering programs are well-positioned to provide critical support for this regional revival, ensuring that PEP continues to fulfill Tulane’s greater mission of scholarly, educational, and community impact.

**Outreach –**

**Get the GiST and Get Inspired: Girls in STEM at Tulane**

The Girls in STEM at Tulane (GiST) program provides fifth through seventh grade girls with the opportunity to meet and work with women role models in science, technology, engineering, and math (STEM) fields. Workshops developed and led by faculty and student teams in the School of Science and Engineering (SSE) encourage and empower girls to inquire, investigate, and discover in a positive environment. Our goal is to open the doors wide and welcome young students to careers in STEM fields by encouraging creative thinking, promoting self-esteem, and increasing awareness of their opportunities. On February 23rd, 2013 the SSE community, with support from the Newcomb Institute, hosted 120 middle school girls from 38 schools in southeast Louisiana. Faculty members and students in nine SSE departments ran STEM activity welcome tables and workshops for our participants. GiST is now offered every semester with our next event March 29, 2014. Please email Dr. Michelle Sanchez at gist@tulane.edu for more information. The following quotations from undergraduate and graduate student group leaders reflect the positive outcomes of GiST:

“The day was great! The girls were engaged and positive about the workshops, enjoyed answering and discussing different science questions and how creativity relates to science. I think that it is important to help the girls understand that they can build a network of supportive like-minded females whether they are to assist them in problem-solving, idea collectives, or general support.”

“The students I interacted with were really inspired by the workshops they attended. I am certain that they walked away from the day having learned a lot, and with new interests in science. For example, one student who started the day saying she was interested in computer science said that after the physics workshop she was considering physics as well.”

**Tulane Science Scholars Program**

The Tulane Science Scholars Program (TSSP) is a selective program for high school students who have exceptional talent in the sciences and mathematics. This year’s summer program includes
four 3-credit courses – Materials Science and Engineering, Chemical Engineering, Psychology, and Neuroscience. Each of the four TSSP courses is offered for three hours of Tulane credit (which may be transferable to another university) and has a $1250 fee. Tuition waivers may be available for students demonstrating a high need. Please email Dr. Michelle Sanchez at tssp@tulane.edu for more information.

Profs. Mao, Kaplan, Chrisey, Talbayev, Wei, and Escarra in the Physics and Engineering Physics Department are teaching the Materials Science and Engineering course “Materials Camp”. Graduate students from the Department of Physics and Engineering Physics are also actively involved by helping in lab demonstrations, equipment training, and hands-on guidance.

Materials science is an interdisciplinary field applying the properties of matter to various areas of science and engineering. The two-week “Materials Camp” course is intended for high school students who wish to explore and stimulate their interest in materials sciences and engineering. The course consists of rotations between five materials science research laboratories in the department. Each rotation combines lectures with hands-on laboratory activities to excite students and introduce them to contemporary methods and issues in superconductivity, optics and lasers, biomaterials, nanomaterials, nanotechnology, and energy harvesting material and technologies. Emphasis is placed on demonstrating basic principles and active and hands-on student involvement. Students have access to high-tech equipment and professional mentors to help them tackle real problems facing the field today.

In summer 2013, 13 students from local high schools in the New Orleans region and 19 international undergraduate students from Nanjing University (China) attended Materials Camp. Students were given course credits according to the required minimum 70% attendance and the grade from a written two-page essay due at the end of the two-week course. Extensive field trips and research facilities tours to Louisiana State University and University of Houston were also arranged for the international students during the last few days of summer camp.

Success Stories –

Kyle Damborsky, Ph.D. – B.S. Physics 2007

Upon graduating with my B.S. in Physics from Paul Tulane College, I moved immediately to College Station, TX and entered the Physics Ph.D. program at Texas A&M University. I’ve spent the past seven years completing my degree and will officially (and finally!) graduate this May with my Ph.D. in Physics. As a graduate student, I’ve worked on a prototype high-field accelerator magnet, fabricated superconducting wires (my dissertation topic), helped design magnets for a high power cyclotron, worked with NASA on the AMS II mission, received my first patent, and somehow found myself in an episode of the Discovery Channel’s “Weird or What?” series. If someone had told me I would do one of these things when I graduated from Tulane, I never would have believed them. By the time I left Tulane, my only experience with superconductors was in Dr. Wietfeldt’s modern physics course, when he brought in a piece of YBCO and levitated a rare earth magnet. At the time, I remember thinking that was a cool trick, but didn’t really see

Salmon fishing at CEC-ICMC June 2013 in Anchorage, AK.
myself working with superconductors in the future, I was going to be a theorist. Despite the fact that my career took a 180° turn, the preparation Tulane Physics provided me was a solid foundation on which to build my career. This is almost solely because of the dedication Tulane professors place on undergraduate teaching and research. In every course at Tulane, I remember the professors making me feel like my course was the only thing that mattered to them, a sentiment I can’t share from my graduate education. Also, because of the degree format at Tulane, I was also able to take graduate level courses as an undergraduate. Seeing Jackson before I had to take it in graduate school was a lifesaver, but so were the upper-level math classes I had time to take.

With that said, the most important preparation that Tulane offered me was undergraduate research. Dr. Kaplan’s patient guidance and mentorship during all four of my years at Tulane were instrumental in making me an investigator, not just a student. While my current field is a long way from calculating scar intensity statistics in a semiclassical regime, the experience of working on an independent research project was invaluable. More than anything, Dr. Kaplan provided a good example of regimented, disciplined research that I’ve carried with me to this day. He also gave me room to make mistakes and identify the bad habits I didn’t want to carry with me.

Presently, I’m concluding my research at Texas A&M while riding the “Find-the-right-postdoc” merry-go-round. And to make sure I keep busy, I’m working with the company I co-founded in 2013, Applied Conductors, LLC, to develop advanced manufacturing techniques for superconducting technology used in accelerators, the medical field, and research applications.

To current and future students at Tulane, I’d like to offer one piece of advice: Always find joy in learning and sharing science because you never know what new piece of physics may inspire you or whom you will inspire along the way.

Harold Hatch, Ph.D. – B.S. Chemical and Biomolecular Engineering, double major Physics, minor Mathematics, Summa Cum Laude 2008

After graduating from Tulane with a double major in Chemical Engineering and Physics, I entered graduate school at Princeton and performed research in chemical physics with Prof. Pablo Debenedetti and Dr. Frank Stillinger while supported by the National Science Foundation Graduate Fellowship and the Princeton Gordon T. S. Wu Fellowship. After graduation from Princeton in the fall of 2013, I am currently a National Research Council Postdoctoral Research Associate at the National Institute of Standards and Technology supervised by Dr. Vincent Shen. My research involves statistical mechanical theory and molecular simulation methods applied to protein folding and aggregation, hydrophobic hydration, and the origins of biological homochirality. Many people I met at Tulane inspired me toward a career path that I enjoy. For the sake of brevity I will only mention that Prof. Hank Ashbaugh in the CBE department is a great mentor and Prof. Wayne Reed inspired me to pursue more study in physics. I remember Prof. Reed’s examples of fishing and playing guitar in his general physics class. He also had the enthusiasm and seemingly endless energy to use an entire box of chalk in one lecture. Finally, it was suggested that I end with some advice for current students. Don't hesitate to interact with the department and ask questions. Of course you can ask questions about homework, but also consider asking about careers or other curiosities. And don't
hesitate to send me a message. My contact information is on my website (hhatch.com).

Conrad Wall, III, Ph.D.
- B.S. Physics 1962, M.S. Physics 1968

After I received my BS and MS degrees I worked as a staff instrumentation engineer at the Michoud Plant on the Saturn V moon rocket until I left to pursue my Ph.D. in Bioengineering from Carnegie-Mellon University. I got an NIH Post Doc at Pitt Medical School, and was asked to join the faculty to start up a clinical laboratory to test the inner ear’s vestibular, or motion sensing, system. This system, like an inertial guidance system, can sense both angular and linear motions in three axes. I was in the first wave of bioengineers who brought engineering technology to the clinical departments of medical schools. I was successful in getting funding for vestibular research from NIH, NASA, and the Whitaker Foundation.

I am currently a Professor of Otology and Laryngology at Harvard Medical School, with a joint appointment at MIT. I have supervised a number of graduate students. I founded and direct the Jenks Vestibular Diagnostic Laboratory at the Massachusetts Eye & Ear Infirmary. I am a Fellow of the American Institute for Medical and Biological Engineering.

My research focuses upon prostheses for balance including acute electric stimulation experiments in humans, and non-invasive devices with body-mounted motion sensors to let subjects control their body sway using vibrotactile feedback. My other areas of research include sensory interaction of motion with vision, tests of human posture and gait, and the application of multivariate analysis to vestibular function testing. I have collaborated with a wide range of international and national investigators, and I chair the national standards committee on vestibular function testing.

The NIH funded research I did on vibrotactile feedback as a balance aid produced encouraging enough results that I decided to found a company to bring this device to market. I am thrilled with the possibility of providing balance rehabilitation therapists a new tool to help them treat those who suffer from imbalance, and a balance aid to help prevent millions of falls per year in the elderly U.S. population.

My liberal arts education at Tulane had enough room for 4 years of English or world literature, up though third year French, as well as a Math minor and a major in Physics. Those courses in “the arts” did not go to waste, since I was able to converse over a wide range of subjects and with a wide spectrum of people. They also served me well when writing research papers and grant proposals.

My training in senior level and then in graduate Classical Mechanics laid down a solid foundation for many of the activities I pursued in my career. Professor J. J. Kyame, my MS thesis advisor, was an important role model when I started to advise my own graduate students at Pitt and at MIT. I did a “quick burn” thesis in 6 weeks. Dr. Kyame faithfully dropped by the lab every morning and every evening to “see how it was going.” By making himself accessible, I never got hung up on a problem for long. By his excellent example, he taught me to be accessible to my students.

One thing I have learned is to dare to take risks. It has been worth it to me. “To dare is to lose one’s footing temporarily. Not to dare is to lose oneself.” Soren Kierkegaard.
Bruce K. Rubin, MD, MEng, MBA, FRCPC, FAARC - Tulane University Departments of Physics, Physiology, and Bioengineering, 1975–1981

Earning dual degrees in medicine and engineering at Tulane has given Dr. Rubin a unique approach to medical research, which involves applying engineering principles like taking complex problems and breaking them down into manageable bits and then reassembling everything and expecting it to fit together. That unique perspective has made him one of the most highly cited pediatric pulmonology researchers in the world.

Dr. Rubin has made groundbreaking contributions to the study of respiratory conditions involving the overabundance of mucus, such as cystic fibrosis (CF), middle lobe syndrome, and plastic bronchitis. He has spent his career exploring key respiratory parameters such as aerosol therapy, airway mucus secretion and clearance, and secretory hyperresponsiveness disorders. “Much of what therapists do, be it aerosol therapy, mucus clearance, mechanical ventilation, and so on, involves various aspects of engineering”, he says.

Dr. Rubin’s journey to scientific prominence began in his childhood. A self-described “nerd who challenged teachers,” his interests ranged from the relatively tame pursuits of coin collecting, chess, and reading, to making explosives in the backyard. By the time he was in high school in Miami, FL, his teachers knew they had a gifted student and sent him off to take math and science classes at the local community college. From there it was on to Tulane University for a bachelor’s degree with majors in physics, mathematics, and computer science, followed by a master’s degree in biomedical engineering.

Dr. Rubin’s interest in medicine evolved through his experience working with physicians as a biomedical engineer, and he enrolled in the Tulane School of Medicine, graduating in 1979. His path to respiratory care was solidified when, at age 23, he was a Rhodes Scholar and research fellow in pediatric bioengineering at Oxford University in England. He worked in the biomedical engineering unit of the Department of Pediatrics at Oxford University John Radcliffe Hospital at a time when mechanical ventilation was just being introduced for premature babies. There, he developed algorithms for feedback loop control of mechanical ventilation based upon transcutaneous oxygen and CO2 measurements.”

Dr. Rubin’s research career has taken him from Tulane and Oxford to Queen’s University at Kingston and the University of Alberta in Canada, St. Louis University in Missouri, and Wake Forest University in North Carolina. His current post is the Jessie Ball duPont Distinguished Professor and Chair and professor of biomedical engineering at Virginia Commonwealth University (VCU) School of Medicine in Richmond and physician-in-chief at Children’s Hospital of Richmond at VCU. He has received numerous awards, including the 2012 Jimmy A. Young Medal of the American Association for Respiratory Care (AARC).

Serving as a mentor to respiratory care researchers is an aspect of his work he values and enjoys. “I hope that many more respiratory therapists get bit by the research bug” says Rubin as he shares his five steps to becoming a successful scientist:

Step 1: Becoming a scientist is a process. First, learn to ask lots of questions, and question dogma. Then learn and read enough to formulate alternative hypotheses and explanations.

Step 2: Next, develop a plan for testing these hypotheses and find out what work others have already done. The most attractive hypothesis is of little value if you can’t test it in the lab (for example, anything needing a time machine is out of the question) and is of no value if it has already been well studied.

Step 3: The next step is to get the help and resources you need (money, collaborators, money, equipment, ethics approval, more money) and do the research.
Step 4: This is not enough; you must then analyze and understand and write up the results. Embrace the unexpected!
Step 5: Finally you must get the paper published, a process that requires another set of talents. So don’t be shy about asking for help.
Besides being a leading researcher in his field, Dr. Rubin is an amateur magician. He performs magic tricks to entertain his young patients. He has worked with the well-known physician, activist, and clown Patch Adams and has taught magic to physicians and therapists in 23 countries on six continents. He sees magic as an outlet for creativity and as a way to enhance communication with patients and with audiences.

From the Physics Department, Dr. Rubin remembers Prof. Karlem “Ducky” Riess as an inspirational teacher, who was a scholar and a gentleman with a mischievous sense of humor (unfortunately, Prof. Riess perished during the evacuation following Katrina). When asked to share life lessons with our students, Dr. Rubin says: “These seem to always hit you on the head when you least expect them, so enjoy the ride!”

Graduations –

Physics majors graduated in 2013
Tanya Chen, Ryan Carnegie, Brian Duong, Sara Fitzgerald, Stephen Glindmeyer, Melanie Jensen, Alexander Joss, Derek Kiesling, Austin Lentz, Andrew Pirolo, John Elliott Ortmann, Bryan Quigley, Elizabeth Mae Scott, Katherine Strasser

Engineering Physics majors graduated in 2013
Andrew R. Camden, Olivia Carnes, Alan Didier, Ross Maunders, Sean Ottomanelli, Samuel (Charlie) Sklare, Tess Williams, Dalu Yang

Doctorate degrees awarded in 2013
Pan Hao, Yuan Fang, Jin Hu

Masters degrees awarded in 2013
Bing Xiao, Tianqi Shan

If you would like to help us build the future at PEP by donating your time or money, your support would be most welcome. Please contact Prof. Zhiqiang Mao (zmao@tulane.edu).

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