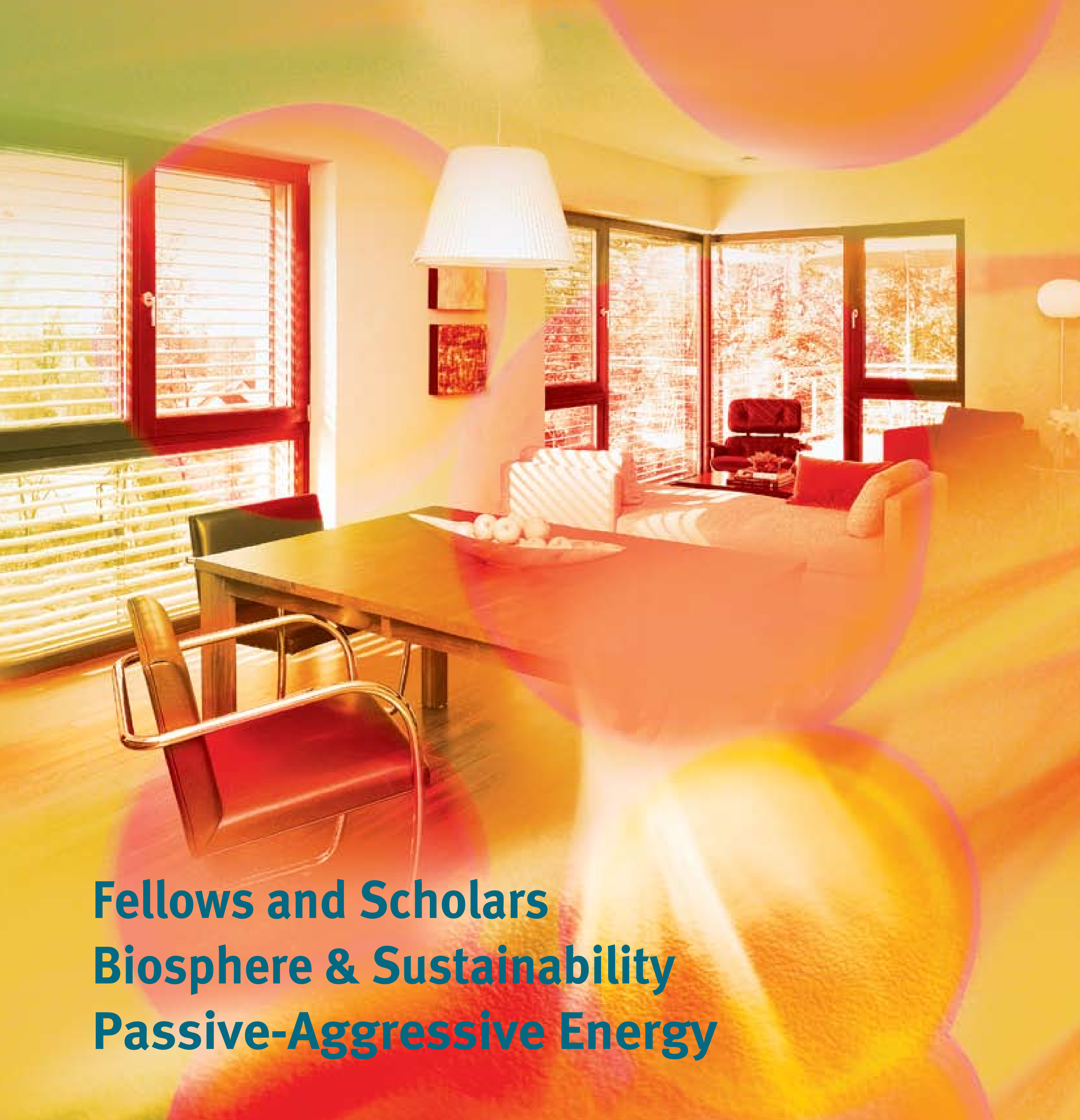
THE BENT

OF TAU BETA PI · The Engineering Honor Society · SUMMER 2011



Fellows and Scholars
Biosphere & Sustainability
Passive-Aggressive Energy

the **Bent** *of* Tau Beta Pi The Engineering Honor Society

SUMMER 2011
Vol. CII / No. 3

Founded at Lehigh University, South Bethlehem, PA, June 15, 1885, by Edward H. Williams Jr., A.B., A.C., E.M., Sc.D., LL.D. (1849-1933). Key and name registered in U.S. Patent Office. Member, American Society for Engineering Education and (co-founder) Association of College Honor Societies. Affiliate, American Association for the Advancement of Science.

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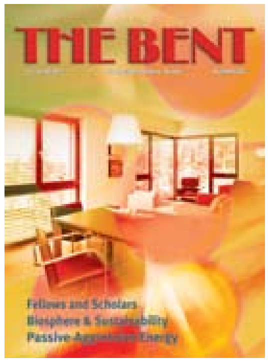
ON THE COVER: Trudy Bell examines new thinking on ways to meet household energy needs from the elements already present. Dr. David F. Ludwig and Timothy J. Iannuzzi explain the origins of the ecosystem and sustainability debate.

Cover artist: Dali Polivka



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The Tau Beta Pi Association was founded at Lehigh University in 1885 by Edward Higginson Williams Jr. to mark in a fitting manner those who have conferred honor upon their Alma Mater by distinguished scholarship and exemplary character as students in engineering, or by their attainments as alumni in the field of engineering, and to foster a spirit of liberal culture in engineering colleges. —Preamble to the Constitution

COUNCIL'S CORNER

A MindSET for Public Service

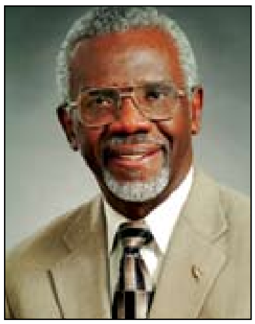
In October 2010 the Tau Beta Pi annual Convention was held in King of Prussia, PA. This location enabled members to celebrate the Society's 125th Anniversary at Lehigh University where TBΠ was founded in 1885. There, Founder Williams dreamed of establishing an organization that would endure the passage of time. Celebration of our 125th anniversary represents a clear demonstration of the confidence he had and is a clear reminder of our enormous potential. From that relatively insignificant start, we have advanced to our current status of more than half-a-million initiates and 237 active collegiate chapters. Today we are proud of what has been accomplished by our remarkable Association since its establishment 126 years ago.

This foundation has provided us with a tremendous springboard for the future and has equipped us to look outwardly, seeking opportunities for greater public service involvement by our membership. This is probably the most significant thing that we can do, as we join forces with others to address the many challenges faced by our nation and the world in the transition from an agrarian to a technological society. By virtue of our professional affiliation, TBΠ members have contributed, and will continue to contribute, to solutions of the technological and social challenges encountered daily. Such problems may impact the health, safety, and welfare of communities at home and worldwide. Volunteerism opens the door for us to contribute to society's needs in many ways.

It is my strong belief that TBΠ is ideally placed to create societal change in a memorable way. Through such change, we can positively impact our nation's progress toward a globally competitive and prosperous future. As we position ourselves for the next 125 years, we can chart our path to success by embracing service opportunities that exist in our communities. We can participate in the technological revolution as professional engineers and through activities such as the K-12 math and science TBΠ MindSET Program. I am involved with this and similar programs because I believe that there are few better ways for those with my training, skills, and abilities to give back to their communities. We can contribute by volunteering to assist in the preparation of our K-12 students for 21st Century careers. Such a gift of our time and involvement has the potential of impacting successive generations.

Today our TBΠ MindSET Program is gaining needed traction. We have about 45 chapters in various stages of program implementation, 11 of which offered engineering labs to K-12 students during the Spring 2011 semester. This represents dynamic growth, because two years ago there was just a single collegiate chapter involved in this major initiative started during this Executive Council's first four-year term. One indication of our progress is that participating school districts are now encouraging us to involve more schools in the local MindSET projects. In addition, we have prepared two teacher professional development modules for delivery to math and science teachers in elementary through high-school grades.

Our chapters are coming onboard at a satisfactory rate, but there are certain challenges facing us. Included among them is the real need of alumnus professional support for those chapters involved in MindSET projects. Corporate partnerships are also being sought for the laboratory sessions. Alumni are needed as volunteer MindSET Program advisors, members of the National and Regional Management Committees, participants in various Saturday engineering laboratory sessions being hosted by the chapters, assisting chapters in interfacing with school districts, and mentoring chapters. Our Chapter Implementation Teams (CITs) are being groomed for leadership succession, and the various roles are described on our program website: *tbpmindset.org*.



Through MindSET, we have a wonderful opportunity to shape our future as an organization, while contributing to strengthening of the educational foundation needed to advance our nation's prosperity. We are deeply indebted to those alumni who have embraced the TBΠ MindSET Program from the outset and who have worked in various capacities, generously contributing time and financial resources to bring us to this point of active development. We hope that as the program expands, our volunteers will continue to demonstrate their commitment and dedication to the MindSET vision and the next 125 years of remarkable success of this great Association.

—**Jonathan F.K. Earle,** Ph.D., P.E., *Florida Alpha '65*,
Councillor & MindSET Administrator

ΤΒΠ ANNOUNCES EXECUTIVE DIRECTOR, SECRETARY-TREASURER, AND EDITOR-DESIGNATE

Curtis D. Gomulinski, *MI E '01,* has been chosen to succeed **Jim Froula,** *TN A '67,* as the next Executive Director, Secretary-Treasurer, and Editor of The Tau Beta Pi Association. The official changeover will occur at the 2011 Convention in October.

Initiated into ΤΒΠ in 1998, he served for two years as Chapter President and spearheaded the successful bid to host the 2002 Convention in Detroit. In 2002, he assisted local alumni to reactivate the Southeastern Michigan Alumnus Chapter and began his volunteer role of District 7 Director. In 2008, he added the role of Chapter Advisor to Michigan Gamma at the University of Michigan.

He holds a bachelor's degree in electrical engineering from Wayne State University and a master's degree in computer science and engineering from the University of Michigan.

Curt serves as a lead project engineer in the plant information technology department at the University of Michigan, leading an array of infrastructure projects including the execution of virtualization, storage, networking, and database solutions serving the needs of plant operations. He joined the university in 2003 as a system administrator for the network services group in plant operations. For six years, he was responsible for numerous server systems and departmental applications as well as identifying and implementing process improvements. He served for one year as an interim manager, responsible for budgeting, accounting, employee supervision, and policy development.

Curt met **Tricia Schwaller Gomulinski,** *SD A '98,* through their mutual involvement as District Directors. Befitting their shared dedication to ΤΒΠ, he proposed to her at the 2010 District 12 Spring Conference in Laramie, WY, and they were married on New Year's Eve in metropolitan Detroit. He enjoys traveling, hiking, and learning to play the piano. Curt looks forward to this new opportunity to serve the Association, and he and Tricia are excited to be settling in the Knoxville area.

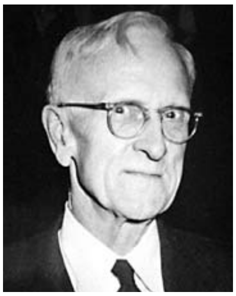
QATAR INITIATION IN APRIL

An historic international initiation of Tau Beta Pi members was held in Doha, Qatar, on April 20, 2011. Nineteen undergraduates and one alumnus candidate were initiated by ΤΒΠ faculty members at Texas A&M University at Qatar and became members of Texas Delta. Collegiate members of Texas Delta Chapter in College Station joined the initiation team. The branch campus has four ABET/EAC engineering programs under the leadership of Dr. G.K. Bennett, P.E., *FL Γ '62,* vice chancellor and dean of engineering, Texas A&M University, College Station, TX.

EDITORIAL

Welcome, Curt

In October 1946 by action of the Convention, Tau Beta Pi Secretary-Treasurer R.C. Matthews, *IL A 1902*, (below) was retired in August 1947 after 42 years of service to the Society and re-titled as our inaugural Secretary-Treasurer Emeritus. "Red" was carrying an increased load in his teaching capacity at the University of Tennessee, as well as the load of 76 collegiate chapters, and he requested relief. Consequently, a young bridge engineer already serving as Editor of THE BENT and living in Knoxville, TN, was offered Red's job, accepted it on an experimental basis in August 1947, and served with distinction for 35 years. Robert H. Nagel, P.E., *NY Δ 1939*, (below) succeeded Red, grew the Association successfully into an organization of 190 collegiate chapters, retired in 1982, and was named Secretary-Treasurer Emeritus in 1983.



As Bob planned his retirement in Spring 1981, the Executive Council offered a unique opportunity to a young engineer and Tau Beta Pi District 12 Director in Colorado to work with Bob and learn the business that he would manage as Bob's successor. We had not applied for that opening, but gladly accepted that offer, moved to Knoxville in the summer of 1982, and officially succeeded Bob at the 1982 Convention. There was some apprehension that was expressed by Tau Beta Pi leaders about our "interest and abilities in editing." However, after publishing our first 113 issues of THE BENT, we remain clearly interested in this quarterly publication, but continue to share some apprehension about "our abilities."

In Spring 2011, the Executive Council offered a young engineer and Tau Beta Pi District 7 Director in Michigan an opportunity to follow a new career path and learn the responsibilities that he would assume as our successor. He happily accepted the offer, will move to Knoxville this summer, and will officially be named Executive Director, Secretary-Treasurer, and Editor at the 2011 Convention. Curtis D. Gomulinski, *MI E 2001*, is a great choice by the Council, and all members need to give him our full support. Curt will grow into this job and over time will lead Tau Beta Pi to even greater visibility and international respect.

The Association is fortunate to receive a double-bonus with Curt because his recent bride, Tricia Schwaller Gomulinski, *SD A 1998*, has also served Tau Beta Pi effectively for more than a decade. She was a host chapter member at the 1996 Convention, was a voting delegate at the 1997 Convention, and has served as an excellent District 12 Director since 2000.

As the Society enters its 127th year, it is the right time for another Secretary-Treasurer—Tau Beta Pi's fourth—to take the controls. Pay attention, Curt. You will need to remember how this transfer process works the next time it is needed, perhaps in Tau Beta Pi's 159th year in 2043.

J.D.F.

IRA ROLLOVERS RETURN!

You senior Tau Bates can once again make tax-free donations to TBΠ for a limited time from your IRAs if you are **age 70½ or older**. A recent law allows tax-free charitable donations from an IRA under simple conditions! You must act before December 31, 2011.

This is good news for anyone contemplating making a major gift to TBΠ or another qualified charity. Under the Tax Relief, Unemployment Insurance Reauthorization and Job Creation Act of 2010, any donor age 70½ or older may contribute up to $100,000 annually from an IRA account and avoid federal-tax consequences. The charitable gift amount can count against the donor's required minimum distribution (RMD).

When the amount withdrawn from the IRA account is paid directly to the charity, it is not counted as federally taxable income. However, because the gift would be excluded from income, it may not be included as a charitable deduction on a federal tax return. These rules will apply to gifts made through December 31, 2011.

For more information about helping TBΠ, please call Pat McDaniel, Director of Development, at 865/546-4578, or see *www.tbp.org/pages/giving*.

You should always consult a tax professional if you are thinking about making a major charitable gift or a gift under the new law.

"TBP" JOB BOARD

Tau Beta Pi has a state-of-the-art job board through a partnership with JobTarget. Members can post résumés, browse nearly 600 engineering jobs, faculty positions, and internships, and employers may browse résumés.

Job postings are updated weekly—visit *tbp.org*.

Constitutional Amendment Ratified

The 2010 Convention approved one amendment to the Constitution and Bylaws of Tau Beta Pi and sent it to the chapters for ratification. In accord with the Association's amending procedure, with 236 chapters eligible to vote, 177 or more affirmative chapter votes are required to ratify an amendment, and 60 or more negative votes would defeat it.

The voting deadline was April 1, 2011. Headquarters received 200 valid ballots (plus 7 invalid for lack of a chapter quorum). The proposed amendment was therefore ratified.

Amendment	Outcome
1. Allow multiple Officers and Directors to serve as advisors to a Convention committee, and correct an error in the procedure of selecting the Convention Chair. Const. Art. III, Sec. 2 (b) & (d).	1. Ratified by chapter vote; 186 affirmative, 14 negative.

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Email information to: addresschange@tbp.org

Or complete this form and mail to: Tau Beta Pi / P.O. Box 2697 / Knoxville, TN 37901-2697

LETTERS

Self-Regulation & Human Knowledge

• A friend and colleague, Bruce Beihoff, sent a copy of "How Concepts of Self-Regulation Explain Human Knowledge" in the Winter 2011 issue of The Bent. It left me very grateful for what you wrote and the way you wrote it. Not only is your writing clear, direct, and helpful, your ability to take a complex and sometimes seemingly esoteric subject so very accessible, interesting, and instructive is a gift. I am grateful for being a beneficiary of your gift and congratulate you on your stewardship of it. Thank you for doing such an elegant job with this article. I hope it is widely distributed and widely read.

Lanny Vincent

• I thank you for your superb article, which came to me under the cover of The Bent. Profound. I am applying it to folks in recovery from substance abuse. There is a subset of these who think they are too intelligent to follow mundane prescriptions. If it's simple, it must be wrong, because they are too intelligent to have made simple errors. The logic to which they are welded led them to behavior which got them addicted (dysfunctional).

I hope you can see how self-regulation (deficient in addicts) presented as prerequisite to developing a workmanlike model of reality (knowledge) can be useful in introducing the cognitive dissonance necessary for those who are too clever by half to question their mindsets. I also greatly appreciate the bibliography. Coming up with a *short list* of blue-chip sources on this much-talked-around topic was icing on the cake. Thank you, thank you.

Terry Romano

Lyle's Laws

Almost every issue of The Bent contains something that is of personal relevance to me, and Spring 2011 is no exception. "Lyle's Law of Reasons" addresses ethics ("Integrity and Excellence in Engineering"—the motto of TBΠ, with Integrity having first billing).

In 1957 as a night-school student, I was honored (and surprised!) by being invited to TBΠ. One requirement for initiation was to write an original paper. My title was "The Multiple Responsibilities of a Professional Man" (now that would be *Person*). It described ways I believed an engineer should act to bring honor and do justice to his profession, society, and family. At the time, I was in senior management, and in those days some of my statements were quite controversial.

Over the decades, I tried to simplify my thoughts, finally distilling the original two pages to two sentences and guidelines. When considering a personal action I apply these two tests: 1) "Would I do the same if everyone in the world were watching, knowing what I was about to do?" 2) "And would I still do the same if I became invisible and anonymous, and no one but me would ever know it was I who did this?"

If I am able to answer *yes* to both questions, I'm probably doing the right thing for the right reason. The first question relates to the suitability of my action. The second one addresses the motive behind my decision.

I hope the value of the *integrity* part is being learned, by discussion and by example, in the halls of academe these days and in the home also.

I look forward to the arrival of every Bent. (P.S. Good health and happiness in your forthcoming retirement … for many years!)

Martin Dvorin, NJ Γ '58

• I don't know if Lyle has a law for this, but there ought to be a law. *When you have a great factory that can make anything, there is a great temptation to make more things than you should.*

I once worked for a company that made complicated mechanical products. We made our own screws and nuts, flat washers and lockwashers, concentric and eccentric shoulder screws, thin and thick nuts, round-headed and hex-headed screws, and springs. The result was a proliferation of part numbers that strained the inventory-control system and required repair centers to stock a huge variety of rarely needed spare parts.

I was reminded of this recently when reading a comment by Gordon Bell on the demise of Digital Equipment Corporation.

> *By the mid-80s DEC had become a classic, well-run vertically integrated industry. By the mid-90s, the industry had become disintegrated and a completely horizontally structured industry. Digital did not need to manufacture its own disks, tapes, and especially semiconductors and microprocessors! The make-buy policy that I posited to prevent inventing and building everything, was "Make what you sell, NOT what you buy." Alternatively, "if you make something, it has to be competitive at that level of integration—otherwise buy it." [from an appendix to the book "DEC is Dead, Long Live DEC: the lasting legacy of Digital Equipment Corporation" by Edgar H. Schein,* et al.

James H. Haynes, AR A '60

Skills for Success

• Thank you for publishing "Skills for Success in Engineering and Beyond: Getting Your Ideas Adopted" by Dr. Peter J. Denning in the Spring 2011 issue. *Innovation* has proliferated well-beyond the borders of definition as *Quality* did 30 years ago. Introducing disciplined practices and procedures coupled with value-assessments in the process of innovation is so desperately needed; this article has done justice in establishing this early foundational framework.

David W. Clark, P.E., PA Λ '86

Thanks Tau Beta Pi

• I really love The Bent, though I've just passed 90 years of age!

Roger K. Owen, P.E. (ret.), TX B '48

Appreciative Scholars

• Thank you for my TBΠ Scholarship. It's remarkable and appreciated that any one society can provide so much assistance to so many students. I am honored because it shows how much you are dedicated to my education. As I fund my education through scholarships and summer work, your contribution helps in many ways. Your actions help ensure that I can gain a college education and come out on top.

I am the vice president of the ASCE chapter and an active member of the steel-bridge team. These organizations have been a great learning experience for me and will help develop my leadership skills. I plan to strive for the best education I can. Your contribution is much appreciated by all, and I hope you keep assisting students in the future.

Anthony T. Kulesa, SD A '12

• Thank you for selecting me to receive a TBΠ Scholarship. This recognition and financial assistance is meaningful to me in the pursuit of my education and obtaining my degree in civil engineering.

Gregory A. Weissmann, CA Φ '12

• Thank you for selecting me to receive a scholarship. It is a huge honor to receive any award from such a prestigious group of people. It will be very helpful as I continue my pursuit of electrical engineering. Thank you for your support of my education.

Cameron L. Mock, WY A '12

Engineering, War, & Twin Towers

• I express my gratitude to Editor James Froula, P.E. (ret.), the Executive Council, and staff of The Bent for being one of the few journals, if not the only one, willing to take an objective approach in its letters-to-the-editor section by allowing engineers who are willing to stand up and disagree with the government's and media's official fires-caused-the-collapse theory to express their professional views concerning the less than 12-second destruction of each of the Twin Towers, as well as the seven-second collapse of the 47-story WTC Building 7 on that fateful 9/11 day nearly ten years ago.

William A. Rice, P.E., MA Z '62

• Thank you for sharing three letters in the Spring issue regarding the World Trade Center. Dr. Delagrange's article has sparked an important discussion that is long overdue. I appreciate Mr. Dukelow's thoughtful comments about the mechanical properties of steel and sprayed fire-resistive materials. He should not be so quick, however, to dismiss Mr. Mizzi's and others' comments. I respectfully disagree with the statement in his letter: "The NIST investigation that Mizzi criticizes was both high quality and comprehensive, given the challenges of establishing causes when much of the evidence is in a burning pile on the ground." This statement hits the proverbial nail squarely on the head. In other words, how can the NIST investigation be described as "high quality and comprehensive" when abundant evidence from the burning pile of debris was mostly ignored?

A fact sheet *(wtc.nist.gov/pubs/factsheets/faqs_8_2006.htm)* states: "NIST investigators and experts from the ... ASCE and the Structural Engineers Association of New York who inspected the WTC steel at the WTC site and the salvage yards found no evidence that would support the melting of steel in a jet-fuel -ignited fire in the towers prior to collapse. The condition of the steel in the wreckage of the towers (i.e., whether it was in a molten state or not) was irrelevant to the investigation of the collapse since it does not provide any conclusive information on the condition of the steel when the towers were standing."

The condition of the steel following collapse was irrelevant? The NIST investigation did not follow the procedure outlined in the national standard NFPA 921 *Guide for Fire and Explosion Investigations*, which is specific with regard to data collection and preservation of evidence: "Valuable physical evidence should be recognized, properly collected, and preserved for further testing and evaluation or courtroom presentation." This is common sense. Why did NIST not consider the composition of the toxic dust in its seven-year study? Thousands of hours of computer simulation are no substitute for a forensic investigation.

There was evidence of melted steel and iron found in the debris whether we like it or not. FEMA 403 Appendix C authors concluded in 2002: "A detailed study into the mechanisms of this phenomenon is needed to determine what risk, if any, is presented to existing steel structures exposed to severe and long-burning fires."

NIST investigators failed to reconcile the extremely high temperature data and the presence of highly-reactive pyrotechnic compounds with the fire-induced collapse hypothesis. Debris samples should have been tested for residues of explosives and exotic accelerants as outlined in NFPA 921 Chapters 18 and 19, considering the unprecedented destruction of all three high-rise buildings. NIST did not consider all available data with attention to all relevant details as required by NFPA 921, so the investigation was inconsistent with basic principles of scientific inquiry and scientific integrity. The terms *high quality* and *comprehensive* cannot describe the NIST investigation.

Ronald H. Brookman, S.E., CA Λ '84

Climate Con

• Perhaps I am one of the "deniers" who Leonard Zimmerman in the Winter 2011 issue of THE BENT suggests for re-education at the feet of warm-mongering politicians and on-the-take "experts," but I prefer to form my opinions based upon an examination of the facts. Thus, I have read many books and articles on *global warming*.

Based upon Edward R. Coleman's letter (Summer 2010), I read and reread *The Discovery of Global Warming* by Dr. Spencer R. Weart, *MI Γ '25*. Presuming this to be the last word on the subject, I expected to see real information explaining why the trace gas, carbon dioxide, is regarded by some as the main cause of warming the entire world's atmosphere. I found this book to be a history of the discovery of global warming, as expected; but the book is otherwise just more propaganda, with little useful information.

In my search for real information I came upon *Climate Con?* by William B. Innes. This book proved to include a better history of so-called global warming, as well as a great deal of real information and a list of 100 books and articles for further study. I found that CO_2 is indeed a strong infrared-blocking gas, but only in two very narrow frequency bands in the spectrum of interest. In these bands, CO_2 at the existing concentration completely blocks the transfer of radiation to space. Adding more CO_2 to the atmosphere would have no effect on global temperature whatever. Water vapor, by far the greatest of the infrared-blocking gases, is not as strong a blocking gas as CO_2; but it is effective over the entire spectrum, so differences in atmospheric water vapor have a great effect on temperature, particularly at night.

Both books were written in 2007, but the intervening four years have seen many reasons (such as "Climate Gate") to support the skeptics of global warming and virtually nothing to support the promoters of man-made global warming. The book *Climate Con?* is a bit too technical for the novice, but I recommend it to all readers of THE BENT.

Jerry W. Crossett, IA A '61

Metric SI Units Please

• I agree with reader Robert Bushnell in urging THE BENT to switch to SI units, except in certain special cases such as history of technology. I also find that few of author A.D. Delagrange's arguments in favor of preserving U.S. units hold any water. Hexadecimal may be better than decimal for the relatively insignificant reason that it uses fewer characters to represent the same number, but it conflicts with most of the rest of our numbering system, which—including metric measures—is based on decimal. The tired question of CGS vs. MKS is answered by the *American National Standard for Metric Practice* (ANSI/IEEE Std. 268-1992), which clearly establishes SI as the preferred system. Neither the calorie nor any cgs unit is SI. (This 70-page document makes quite interesting reading for anyone interested in units of measure.)

I believe that it is petty to demur adoption of SI by citing specific communities that also use units inconsistent with the rest of the world. Taking Dr. Delagrange's examples, no doubt there are physicists and Japanese toolmakers justifying their own metric idiosyncrasies by noting that the worst offenders against standardization are really those recalcitrant American engineers and that standards bodies should ignore them since they use at least some form of metric. And as for public comprehension of the metric system, I think that consumers would quickly learn their liters and grams if makers of packaged food were required to print their quantities in metric first, and U.S. units in parentheses. (Yes, I did just refer to the liter, which is a non-MKS unit, but it is approved for use with SI, as are milliliters and microliters.)

I almost wish that the architects of the War of 1812 had showed their displeasure with Great Britain and support for France by ditching Imperial units in favor of metric. Ben Franklin, scientist, engineer, and ambassador to France, would likely have approved, had he not died 20 years previously.

Ilya V. Gurin, CA A '07

I'm going to med school!

• You might ask: What medical school would admit someone this old? I answer: Harvard Medical School. My registration documents are in the mail, and acceptance is almost assured. I got on this career path after a chat with my brother-in-law, a doctor-surgeon. I read one book about this general subject, which strengthened my resolve. I'm going as a cadaver, an anatomical gift. I hope I won't be admitted soon, but it will be a fulfillment of my childhood dream of going to med school. And it's the cheapest way to go to med school, tuition-free.

Medical school can make one useful, and it can also make one *green*. Conserve, reuse, and recycle are the key words here, but mostly *reuse*, my favorite. It's too late to conserve, as I'm already born and using resources. Recycle probably won't apply to me. One out of three isn't bad, given it's the best I can do.

Of course *reuse* also applies to organ donation, a worthy act and a higher calling than med school. Donation is most appropriate for younger people. Older organs from those of us who've circled the sun 70 times or more are just not good candidates for transplant. Others who have gone before have been involved in the humanitarian projects of medical research and education. We all have benefited from their generosity. Now we have the opportunity to make better the lives of those who follow.

Please give this some serious thought and consider joining me. We've all benefited from advances in medical science, and here I'm suggesting a way we can pay back a bit of that. I'm hoping that this will create awareness and some comfort in discussing the concept of anatomical gifts.

Waldemar R. Semrau, WI B '58

Brain Tickler Memories

• About to become a mother for the first time, I am surprised by some of the fond old memories that have surfaced spontaneously. My late father (Howard W. Smith, Boeing engineer and professor at Kansas) was a proud member of TBΠ and loyal reader of THE BENT. When an issue arrived, he would turn to the "Brain Ticklers" and work the problems. When I was old enough to enjoy math and logic problems, he shared this ritual with me. I sat with him and read the problems together. He let me work solutions on my own, as well as I could, and we would discuss the answers. He was good at puzzles and usually had the answer, but sometimes we waited until the next issue to learn a solution. I felt so proud when I was able to get the answers on my own! I am convinced that these puzzles contributed to my intellectual development, as well as to my relationship with my father. His influence lives on. I am a professional scientist myself; critical thinking, creative problem solving, and number crunching are rewarding aspects of my work. I will do my best to educate my son to have a good mind and healthy curiosity. Maybe he will even be an engineer too! I encourage readers to share the Brain Ticklers with your children. It may seem like trivia to you, but it could be important to them.

Elizabeth Fabri Smith, Ph.D., KS A '93

Thanks Jim

• I have received your March 2 letter-of-intent-to-retire at the TBΠ October 2011 Convention. My heartfelt congratulations to you! Jim, you've done a wonderful job for the Association. Best wishes for a happy and satisfying retirement!

Robert L. Goodwin, MA Z '58

• I read of your upcoming retirement in October 2011. Although this will be the culmination of an outstanding career at TBΠ as Executive Director and Editor, I'm sure you will take on new challenges (as I have) in the years ahead. I'm certain that the care of the Society is in good hands. There is no greater compliment a CEO can receive than to know that you won't be missed because you've left behind a well-oiled machine! Thanks for your dedicated service to engineering education and practice and for all you have done to make engineering one of our most respected professions.

Peter L. Kern, P.E., NY Λ '62

• Congrats on your upcoming retirement.

Dr. Michael E. Kennedy, TN A '86

TBP coNNect
Tau Beta Pi's InCircle Community

National Inventors Hall of Fame

Two Tau Bates entered the National Inventors Hall of Fame in April:

• **Dr. Martin E. Hellman,** *NY E '66,* was inducted with two others for

developing public key cryptography, which secures electronic communications in areas like e-commerce. Dr. Hellman is professor emeritus at Stanford, and his current focus is the application of risk analysis to nuclear deterrence.

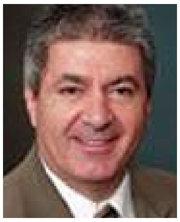
• **Steven J. Sasson,** *NY Γ '72,* an electrical engineer with Kodak, was

asked to investigate whether charge-coupled devices could create an image sensor. He created a device that captured an image, converted it to an electronic signal, digitized the signal, and stored the image—the first digital camera. He joined Kodak in 1973 and works with the company's intellectual property transactions group.

Dr. Karan L. Watson, P.E., *TX B '77,* has been named as ABET's president-elect. She is

provost and executive vice president for academic affairs at Texas A&M University, where she joined the faculty in 1983, and also represents ASEE on the ABET board of directors. **Dr. Jeffrey J. Siirola,** *UT A '67,* was elected ABET secretary at the spring 2011 board meeting. He is a technology fellow at Eastman Chemical Company, was president of AIChE during 2005, and serves on the ABET board.

Sarmad (Sam) A. Rihani, P.E., *Oregon Alpha '77,* has been elected president



of the Structural Engineering Institute. He will assume his new role in October. Rihani is principal of REI Structural Consultants of Reston, VA, a consulting firm serving the Eastern United States. During his 33-year career, he has specialized in structural analysis and design.

Dr. Priscilla P. Nelson, *New Jersey Gamma '79,* has received the Henry

L. Michel award for industry advancement of research, presented by ASCE, a civil engineering award to a leader of the design and construction industry. She is professor in the New Jersey Institute of Science and Technology department of civil and environmental engineering.

Dr. John W. Sutherland, *Illinois Alpha '81,* has received the SAE

International John Connor environmental award, in recognition of his accomplishments to promote the society's environmental vision. He is professor and head of environmental and ecological engineering at Purdue University.

Dr. Sandra A. Yost, P.E., *Michigan Delta '81,* has been elected vice president, external relations, of ASEE. She is a professor in the department of electrical and computer engineering at the University of Detroit, Mercy.

National Academy of Sciences

This year's class of new NAE members included three Tau Bates: **Dr. James W. Demmel II,** *CA B '75,* professor of mathematics and computer science, University of California, Berkeley; **Dr. Harry C. Dietz III,** *NC Γ '80,* investigator, Howard Hughes Medical Institute, and professor of genetics and medicine, Johns Hopkins University's school of medicine, Baltimore; and **Dr. Paul L. McEuen,** *OK A '85,* professor of physics, Cornell University.

Horatio Alger

Two Tau Bates were among those honored as distinguished Americans by the 2011 Horatio Alger awards: **Michael R. Bloomberg,** *MD A '64,* mayor of New York City, and founder and owner of Bloomberg, L.P.; and **Dr. Herbert A. Wertheim,** *FL B '62,* chairman and CEO of Brain Power, Inc., chair of the Dr. Herbert and Nicole Wertheim family foundation, and founding chairman of the Herbert Wertheim College of Medicine at Florida International University.

Christopher E. Singer, *Tennessee Delta '82,* has become director of the

engineering directorate at NASA's Marshall Space Flight Center in Huntsville, AL. He will lead an organization of 1,400 civil service and 1,200 support contractor employees responsible for hardware and software associated with space transportation, systems, and instruments. Singer began his NASA career in 1983 as a rocket engineer.

Dr. Steven M. Sliwa, *New Jersey Delta '77,* has retired after 10 years as president and CEO of Boeing's unmanned aircraft manufacturing subsidiary Insitu.

The Executive Council met in Knoxville, TN, on May 14, 2011.

The Council voted TBΠ Distinguished Service Awards to retiring District 13 and 14 Directors R.W. Mead, *CO Γ '63*, and J.A. Hester, *WA A '88*, and a Resolution of Appreciation to retiring EF Facilitator Jike Chong, *PA Γ '01*. Ricardo K. Komai, *CA T '10*, was appointed as District 8 Director to a term ending June 2013 and Ian J. Frank, *NY Π '09*, as District 14 Director, ending June 2014. The Council re-appointed as District Directors for 2011-14: E.R. Armstrong, J.P. Blackford, D.E. Dale, S.V. Eckersall, L.C. Gascoigne, E.P. Gorzkowski III, R.A. Holcomb, W.A. Hull, S.D. Jennings-King, B.A. Kramer, M.V. Paragano, T.A. Pinkham IV, J. Rogan, and E.A. Stephan and for 2011-12: C.D. Gomulinski.

Engineering Futures Facilitators J.P. Blackford, K.T. Blazevic, C. Cheng, S.C. Dao, P.E., S.P. DeCabooter, S.K. Kramer, M.D. Lauer, M.W. Ohland, A.J. Passman, and N. Pih were re-appointed for 2011-14; and H.R. Bhambhani, Y.C. Chang, W.A. Hillard, B.E. Kabes, A.J. Pinkus, and R. Singhal were re-appointed for 2011-12. Katie S. Samuels, *LA Γ '86*, was appointed as Engineering Futures Facilitator to a term ending June 2013.

Dr. Darrell W. Donahue, *NC A '86*, was re-appointed to the Fellowship Board for a term ending July 31, 2014. The Selection Committee reported that the 2011 TBΠ National Outstanding Advisor had been chosen. The Council discussed expanding the Engineering Futures Program.

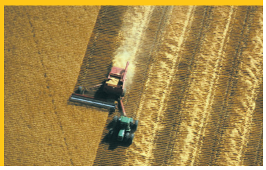
Councillor J.F.K. Earle reported on recent progress in the TBΠ K-12 MindSET Program; the report of a training meeting for five chapters in Laurel, MD, on December 11-12 was received. Project grants with cash awards were given under the MindSET Program to the New York Tau (two), Michigan Gamma, and Florida Epsilon Chapters and under the GIG Program to the Michigan Kappa Chapter, and the local projects will be reported in later issues of The Bent.

Executive Director J.D. Froula reported on the status of the 2010 and 2011 Alumnus Giving Programs, the Heritage Society mailing that was completed in January to 21,400 members, the multi-state charitable-organization registration project, on GEICO's contribution of $14,000 in October for seven TBΠ-GEICO Scholarships, and on the various information-technology improvements; his second- and third-quarter financial reports of the fiscal year had been sent to the Council and were accepted. He reported that chapters had ratified the Constitution amendments from the 2010 Convention that allow multiple Officers and Directors appointed to a Convention committee to serve as advisors and that corrected an error in the actual procedure of selecting, rather than electing, the Convention Chair. The Council approved a named Charitable Gift Annuity Fund for a $100,000 charitable gift annuity arranged with a donor. The salary schedule for the Headquarters staff was modified in accordance with merit policy and the cost-of-living index.

The Council approved the name change of the reactivated Grand Rapids Alumnus Chapter to the West Michigan Alumnus Chapter. Mr. Froula reported that the Texas Delta Chapter had initiated 20 members at the Texas A&M University-Qatar branch campus on April 20.

The Council reviewed arrangements for the June 11, 2011, meeting of national officials to be held in Knoxville.

The Council discussed the results of interviews on May 12-13 with the final two candidates for the position of Executive Director of the Association.



Lyle's Law of Comfort

Over the years, my wife has learned to be wary whenever I start a sentence with, "What would you think of…?"—and with good reason. For example, one of the times she heard those words was when I came home and said, "Honey, what would you think of spending a year in China?" To put this in context, we had been married something over 10 years, six of which had been spent living in student housing, planning for the day when we could have a normal lifestyle with a house, a garden, pets, the whole works. Finally we had those things: a job as an associate professor, a home in the country, three children, two cats (one a little psychotic, but hey…) and even a garden. Now comes the suggestion that we suspend all this, pack up, and move to China (actually Taiwan) for a year. This would mean a change of plans. It meant that we would have to rent the house, figure out how to get half way around the world, find a school for the kids, and on and on. It meant, in short, leaving our comfort zone. We weren't sure we wanted to do that. But we did it. And we're glad we did.

Beware the cozy comfort zone.

Leaving your comfort zone is not an easy thing to do, but, whenever we have done so, we have generally been well rewarded. Sure, there have been some bad moments. There have been some times when we were pretty uncomfortable. But in the end, we're glad we took the risk. For all of us, the comfort zone can get pretty cozy, and leaving it requires some effort and some courage. But the cozy comfort zone can be a dangerous place, precisely because we don't want to leave it. Hence, Lyle's Law of Comfort: *Beware the cozy comfort zone.*

I am a member of an investment club, and I enjoy going there and pretending I know something about picking stocks. Fortunately, I have picked enough winners that my fellow members put up with my pretense. Among the many things I have learned from my more skillful colleagues is an appreciation for the risk/reward relationship. If you want to enjoy the possibility of high rewards (return on investment), you must suffer the possibility of large losses. In other words, you have to get out of your comfort zone. A risk must be taken.

But there are different kinds of risks. One is the kind typified by the old joke about the famous last words of redneck drivers; "Here. Hold my beer. I'm gonna try something." That kind of risk is not very well thought through and is made more palatable by a lack of information and more acceptable by impaired judgment. That driver may have left his comfort zone, but he didn't have a very good reason for doing so. In fact, the word *reason* may not even apply here.

Another kind of risk is the risk of getting caught doing something you shouldn't, like breaking the law. The folks at Enron took that kind of risk when they cooked the books, and some of their auditors did it when they looked the other way. Less dramatic—but no different in principle—is the driver who decides to drive 85 in a 55 mph zone. Or the person who cheats on an exam or a spouse and risks the chance of getting caught. Again, they may be outside their comfort zone, but that's not the kind of risk we're talking about here.

So, if we agree to exclude the foolish risk and the risk of getting caught, let's look some more at the notion of getting outside that cozy comfort zone.

In the engineering process, we often need to get outside our comfort zones. Most real-life engineering designs require compromise, and compromise requires an element of discomfort. Any engineer would be most comfortable making a product that is 100 percent safe and reliable, but we know that can rarely be done. So designers need to leave their comfort zone—or perhaps more precisely, stretch that zone—to accept a design that is as reliable as possible while still possessing the other features it needs to meet the design requirements, like cost. Whether leaving the zone or stretching it, the coziness has to be overcome.

Perhaps the coziest comfort zones of all are the ones we create in our careers. It is easy to get into a position where we are good at what we are doing, we are amply rewarded and secure, and we feel we are making a contribution. What's not to like? But that's just the point; a zone can be comfortable simply because it doesn't contain anything that we dislike. That doesn't seem to be a very high standard for living one's life. But it sure can be cozy.

I write this law with some trepidation, because I know that many readers of THE BENT are, as they say, of a certain age. The Law of Comfort should not prompt any of us to say, "I should have … I could have … I might have …." So what? We did what we did. That's that. What the law should do is prompt our younger readers to ask themselves from time to time if they are getting too comfortable. It should be considered whenever an opportunity comes along that is a little scary, a little uncertain, a little uncomfortable. To take advantage of such an opportunity, you have to get outside your comfort zone. You have to leave the comfort zone to take a new job, to start a business or, for that matter, to get married. But the chances are—I really believe this—the chances are you'll be glad you did.

So beware the cozy comfort zone. It is a dangerous place because it is so hard to leave.

—**Lyle D. Feisel,** Ph.D., P.E., *Iowa Alpha '61*

Author's Note: I wish to close this column with a brief tribute to my old friend, Jim Froula, as he retires from Tau Beta Pi. He has served our Society well for these many years, and I'm sure he will remain a loyal Tau Bate in retirement. Jim honors the Law of Comfort (Grand Canyon. Kilimanjaro. Half Dome. Good grief!) and, indeed, was the one who recruited me to write a column for THE BENT *and suggested the name of Lyle's Laws. Happy hiking, old friend.*

And beware the cozy comfort zone.

—**L.D.F.**

Florida Iota Installed

PHOTOS: COURTESY OF ERAU

Charter Presentation
Solange C. Dao, P.E., David S. Kornblum, Dr. Howard D. Curtis, P.E., and Dr. Richard H. Heist (left to right).

THE FLORIDA IOTA CHAPTER of Tau Beta Pi was installed at Embry-Riddle Aeronautical University in Daytona Beach on March 12, 2011. Vice President Solange C. Dao, P.E., was official installing deputy of the Society's 244th collegiate chapter, assisted by Executive Director James D. Froula, P.E. (ret.), and District 5 Director Rebecca A. Holcomb.

The 2010 Convention granted a chapter to the Tau Beta Rho Engineering Honor Society, represented in King of Prussia, PA, by Evan L. Phillips, vice president, and Dr. Howard D. Curtis, P.E., *IN Α '63*, advisor.

The Miller Instructional Center Auditorium on the campus was the site of the formal ceremonies of initiation and chapter installation, witnessed by Michael R. Bernard, *FL Γ '12;* Josuan Hilerio-Sanchez, *PR Α '07;* Andrew K. Lloyd, *FL Γ '12;* Kevin M. Stiner, *FL Γ '12;* and David C. Covey, *VA Γ '10*.

The initiation team included: Dr. Curtis; Nick L. Brixius, *CA Α '69*; Glenn L. McNutt, *TX Δ '62*; Dr. Massood Towhidnejad, *FL Δ '90;* and the five witnesses and three national officials listed above. Twenty-five undergraduate students and one alumna (identified on the facing page) comprise Florida Iota's charter members.

Immediately after the formal initiation, the new members were constituted a new chapter in the ceremony of installation conducted by Ms. Dao. The ceremony included the formal election and installation of the chapter's charter officers and advisors (identified in a photograph caption on the facing page).

A dedication of ERAU's bright new coquina stone-mounted Bent monument outside Lehman Building preceded the banquet, with remarks by Dr. Richard H. Heist, *NY Ξ '67*, ERAU executive V.P. and chief academic officer, and Dr. Maj D. Mirmirani, *CA Ι '67*, dean of engineering. Dr. Heist commended Dr. Curtis for his vision and effort to place the monument on the campus grounds.

At the banquet in the college of aviation atrium, President Kornblum served as master of ceremonies, welcomed initiates, visitors, faculty, and friends, and stated his pleasure in having the new chapter on campus.

Mr. Froula reviewed the history of the ERAU petitioning process and challenged the initiates to pursue excellence in all of their activities, to support the engineering profession, maintain impeccable ethics, and serve their *alma mater* and fellow students.

Ms. Holcomb introduced the visitors, offered her assistance to the new chapter, welcomed Florida Iota into District 5, and reviewed her District communications, operations, and programs.

Ms. Dao welcomed Florida Iota into the Association and encouraged the students to participate in TBΠ activities like Engineering Futures, to build a great chapter, to bring great credit to their university, and to become effective leaders by "seeing beyond the storm" and by "saying yes to ideas."

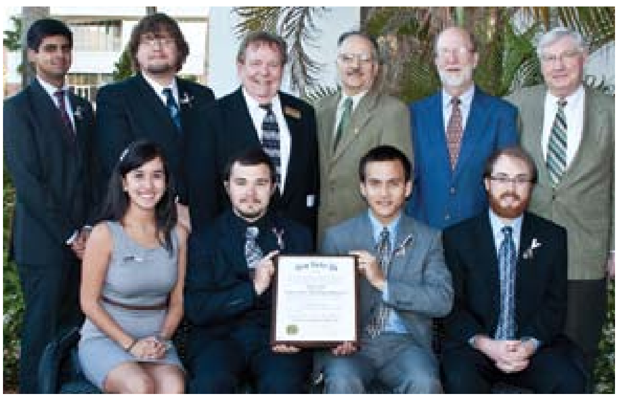
Finally, Mr. Kornblum and Dr. Curtis presented charter membership certificates to the initiates.

Student Initiates
Front row (L-R): Theodore R. Adams, Harris L. Chaiklin, and Jodi L. Clark. (Back row): Charles A. Dempsey, Christine M. Dailey, and Yuvraj Dewan.

Student Initiates
Front row (L-R): Mark X. Dos Prazeres-Silva, Marianne S. Dillard, and Luis E. Ferrer-Vidal. (Back row): Justin T. Forster, Christopher J. Foti, and Michael T. Gerardo.

Student Initiates
Front row (L-R): Matthew D. Gonitzke, Mona Nkirote, and David S. Kornblum. (Back row): Guilherme G. Loures, J. Michael McVicker, Daniel D. Morrison, and Ganesh Krishnan.

Student Initiates and Alumna
Front row (L-R): Brian L. Passarelli, Siva P. Saba, and Alexander G. Saffer. (Back row): Joseph R. Tabarracci, Dean V. White, Laura Tiusaba Guzman, (alumna), and Ryan L. Vas.



First Officers and Advisors
Front row (L-R): Cataloger Laura Tiusaba Guzman, President David S. Kornblum, Recording Secretary Dean V. White, and Treasurer Justin T. Forster. Back row: Corresponding Secretary Yuvraj Dewan, Vice President J. Michael McVicker, and (Advisors) Dr. Howard D. Curtis, Dr. Massood Towhidnejad, Nick L. Brixius, and Glenn L. McNutt (standing in for Dr. Charles F. Reinholtz, FL A '76).

Initiation Team
Front row (L-R): K.M. Stiner, J. Hilerio-Sanchez, S.C. Dao, and R.A. Holcomb. Back row: J.D. Froula, A.K. Lloyd, M.R. Bernard, D.C. Covey, Dr. M. Towhidnejad, G.L. McNutt, N.L. Brixius, and Dr. Howard D. Curtis.

Aggressive Engineering for Passive Houses

The real energy guzzler is not the family car, but the family home. More than 25,000 passive houses built in Europe during the last 20 years demonstrate how engineering can slash residential energy consumption by up to 90 percent.

by **Trudy E. Bell**

Build a house without a conventional furnace in the snow belt of Cleveland, OH—where average annual snowfall is a good five feet and mean winter daytime temperature is 28°F—and heat it with the equivalent of two portable hairdryers? A house that can maintain a comfortable indoor temperature of 68°F year-round, even in summer without a traditional air conditioner?

Exactly such a house is receiving finishing touches right now on the grounds of the Cleveland Museum of Natural History as a demonstration project, and it will be open for the public to tour from the end of July into September as part of a traveling exhibit.[1] Called PNC SmartHome Cleveland, the 3,000-square-foot house will showcase home-construction techniques and technologies developed since the 1990s by the Passivhaus Institut (Passive House Institute) in Darmstadt, Germany, and gaining wide acceptance in Europe to slash dependence on fossil fuels.[2] Indeed, in 2008, the European Union ruled that all new construction beginning in 2016 must meet Passivhaus Institut standards. Although an estimated 25,000 homes built to Passivhaus Institut standards have already been built across Europe, fewer than 100 currently exist in North America—but their locations range from balmy California and tropical Florida to wintry Wisconsin, Maine, and Quebec.[3]

In essence, a passive house is a super-insulated, air-tight structure designed with one primary goal: to reclaim and recycle energy with the highest possible efficiency, to maintain a comfortable interior temperature year-round without conventional HVAC (heating, ventilation, and air conditioning) technology or photovoltaic solar panels. Natural heat sources include not only the sun shining onto the house, but also waste heat from lighting and electrical appliances, the body heat of the occupants, and possibly even the ground itself. Interior air is kept fresh by use of an energy recovery ventilation system, which maintains a steady flow of outdoor air into the house, while filtering it and reclaiming energy from the exhaust air.

Houses as energy hogs

After nearly two decades of measurements and statistics by the Passivhaus Institut in monitoring the performance of passive houses across Europe, the numbers are in. Although the initial construction cost of a passive house can run 10 to 20 percent higher than conventional well-built custom construction, the elimination of a furnace and ductwork represents an immediate savings. But the real payback comes over the first decade from an annual heating bill that is only 10 to 15 percent that of a conventional house. Indeed, the goal for a passive house is to be cost effective: for capital and operating costs to be no more than—and ideally far less than—those of a conventional house over a 30-year mortgage.[4]

The true cost of home-ownership is not just the purchase price, even including the cost of capital improvements (which everyone hopes to make back on resale). It's the total life-cycle cost of operating the house.[5] Buildings are the single largest consumers of energy (49 percent), about equal to transportation and industry combined.[6] Of those, according to the McKinsey Global Institute, "The residential sector is the largest single energy consumer worldwide, and also the one where the largest uncaptured energy productivity improvement opportunities lie."[7]

Let's bring that statistic home, so to speak, with a case in point. As any owner of a charming older house in the winter-dominated Great Plains, Midwest, or Northeast can attest, charm costs dearly. In northeast Ohio, the heating season usually lasts from October through March, but can back into September or edge into May (as this year on May 16 when daytime highs were in the 40s). My 1914 two-story, wood-

The Passive House in the Woods is a 1,940-square-foot private home on a one-acre lot just outside the town of Hudson, WI. Designed by architect Tim Delhey Eian of TE Studio, it actually exceeds PassivHaus Institut space-conditioning requirements by 30 percent. The 22-inch walls have an overall R-value of R-70 and the flat roof R-95. Despite its northern latitude, it has no furnace; south-facing triple-pane windows collect warmth from winter sun. The solar panels provide electricity.

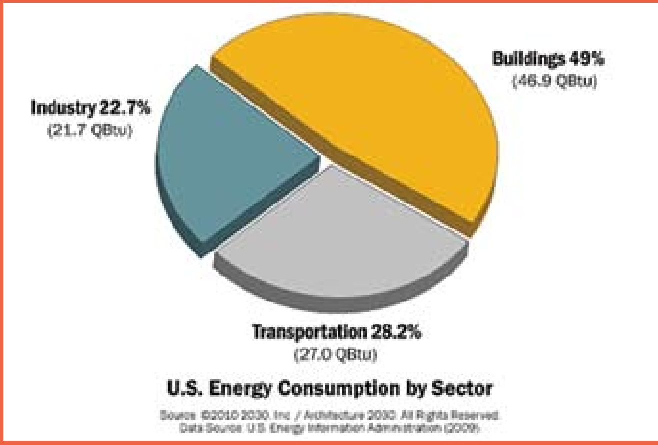
Photos pp. 16-17: Chad Holder *(www.chadholder.com)*

frame house with 2,100 square feet of living area is typical of the local housing stock. Even with the thermostat set to 62°F in the daytime when I am there working, the cost of both natural gas for the forced-air furnace (new in 2008) and small electric oil radiators in my office and bedroom (turned on only when I occupy each room for the day or night) regularly exceed $300 per month in the heating season and have topped $400. When insulation was blown into the walls in December 2010, monthly heating bills dropped to about $225 (even though I bumped the thermostat up to 63°F as a treat). Every energy improvement (insulating the attic, replacing all 30 century-old windows with double-pane windows, caulking gaps) has made a perceptible difference in comfort and heating bills. But there are limits. The construction of this century-old house is inherently drafty—and the inexorable net rise in the cost of fossil fuels over the years has steadily eroded any savings I might have realized.

Upshot: Even at a winter interior temperature many people consider 5° to 10° too cold, heating alone blows $2,000 to $3,000 up the chimney each year, followed by perhaps another $500 for air conditioning in the summer (used only on days when it's 85+°F and muggy). That's money never, ever to be recouped in home value, tax write-offs, or any other way. Multiply that loss by the roughly 190,000 households in the Cleveland metropolitan area, and a bit shy of a billion dollars are annually going up in smoke just in the 43rd largest city in the land. With a nationwide stock of 105.5 million houses[8] —*not counting* office buildings, schools, and stores—American residences alone may be incinerating on the order of a third of a trillion personal dollars every year just for heating and cooling.[9]

So for me, the prospect of maintaining an interior temperature comfy enough not to require a hot water bottle or fleece pullover indoors, for a heating bill of maybe just $30 per month in a Midwest winter, immediately triggered the engineering question: *how?*

Historically, energy costs have not much influenced home design. My 1914 house was built with 2-by-4 studs on 16-inch centers that separated the exterior wooden wall from the interior plaster wall with an air space. That's right, there was zero wall insulation, even for a house built in Ohio. That was pretty typical nationwide for U.S. home construction until the 1970s oil embargo of the Organization of Petroleum Exporting Countries (OPEC), which raised awareness of the energy use of automobiles and homes. In the late 1970s, home construction entered a short-lived energy-efficiency revolution. Some pioneering architects, civil engineers, and home builders experimented with home designs, construction techniques, and the positioning of windows and roofs to maximize solar energy for heating water and the home's interior. Some also experimented with super-insulation in walls built with 2-by-6 or even wider studs. But some design experiments did not work as well as anticipated;



some passive solar houses got uncomfortably hot or cold; photovoltaic solar panels were limited in their efficiency; and calculating an effective design for each local climate (a roll-up of latitude, altitude, wind direction, angle of home site, and other factors) was often complex.

Despite some truly interesting scientific and engineering research and prototypes, the spottiness of success, a bumper crop of architectural designs not pleasing or affordable to many Americans, and a general decline in oil prices in the 1990s together led many families and home builders to return to what felt tried and true: i.e., home-building standards dating back to the 19th century. Moreover, with the heady dot-com technology boom of the '90s, the trend in affluent newer suburbs was to build homes far larger than the U.S. average—those of 3,000 square feet or larger. Today, most builders still design homes purely to meet the layout preferences and aesthetics of the client, and size the HVAC system as needed for the resultant home design. With a few notable exceptions, there is little thought of letting energy efficiency influence, much less drive, the home design.

Meanwhile in Europe, where fossil-fuel prices have always been nearly double those in the U.S., engineering designs of passive houses were first devised in 1988 by Bo Adamson of the University of Lund in Sweden and Wolfgang Feist, a German physicist and architect with an interest in housing, energy, and the environment. In 1991 Feist founded the Passivhaus Institut in Darmstadt, which built the first prototype passive house, instrumented it, and began measuring its energy consumption through the seasons year after year. Its proven performance has since spurred the building of thousands of passive houses, apartment buildings, and schools across Europe. Most innovations for passive houses (and other low-energy houses) have since come from construction companies, national energy programs, and housing companies rather than from the scientific or engineering communities.[10]

First, lose no energy

According to the Passivhaus Institut standard now adopted for central Europe, an energy-efficient house can be certified as a passive house if it meets three targets:

1. *The house must be designed to have an annual demand of no more than 15 kilowatt-hours per square meter (4,746 BTU per square foot) per year in heating or cooling energy, or a peak demand of 10 watts per square meter;*

2. *The total primary energy consumption for heating, hot water, and electricity must not be more than 120 kWh/m2 per year (38 kBTU/ft² per year); and*

3. *The building must leak air in quantities no greater than 0.6 times the house volume per hour at a pressure of 50 pascals (newtons per square meter, or about a pound per square foot) as tested by a blower door.*

"Three main things lie behind the theory of a passive house," explained **Mark A. Hoberecht,** *Ohio Epsilon '78*, head of fuel-cell development at NASA Glenn Research Center, founder of HarvestBuild Associates Inc., and a certified passive-house consultant who advised the Cleveland Museum of Natural History on the design of the demonstration PNC SmartHome. "They are super-insulation, air-tight construction, and ultrahigh-performance windows. If you use all three in combination to virtually eliminate heat losses, passive energy—from sunshine, electrical lights and appliances, and even body heat from the occupants—is enough to keep the temperature of a passive house well above about 50°F in Cleveland's climate, without any additional added energy."

Super-insulation

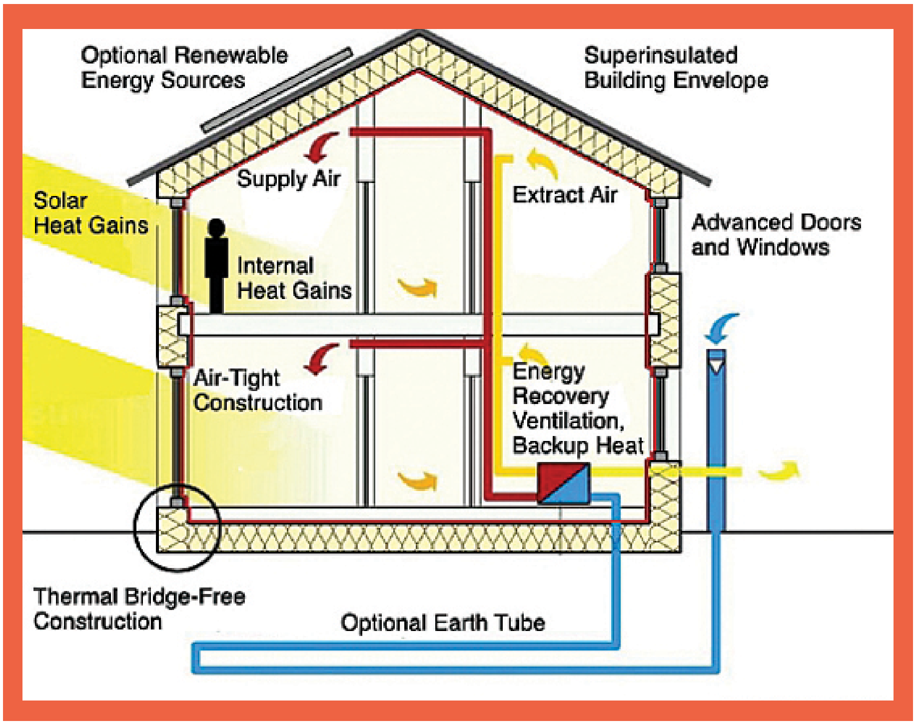
Insulation is rated by R-value, meaning thermal resistance or resistance to heat flow. The R-value of insulation varies with the type of material, its density, and its thickness—the higher the R-value, the greater its insulating effectiveness. The U.S. Department of Energy (DOE) recommends, depending on the climatic zone (U.S. climatic zones range from tropical southern Florida and Hawaii to arctic Alaska), that wall insulation in new wood-frame houses should be R-13 to R-21, with additional insulation wrapped around the house to add another R-5 or R-6, for a total wall insulation of R-19 to R-27. The DOE further recommends that floor insulation be R-13 to R-25 and ceiling (attic) insulation be R-39 to R-60.[11] The DOE numbers are a step in the right direction; however, even in cool northeast Ohio its recommendations seem to be more honored in the breach than in the observance. Last September (2010), several supposedly *green* builders I consulted tried to discourage me from considering 2-by-6 super-insulated walls for R-21, saying that 2-by-6 construction was "much more expensive" than standard 2-by-4 construction.[12]

The Passivhaus standard is far more rigorous than the DOE recommendations. The PNC SmartHome Cleveland demonstration house, designed for the climate of northeast Ohio, has 12-inch walls insulated to R-50. To attain such wall thickness, some passive houses use wider studs normally reserved for floor joists. Furthermore, the PNC SmartHome's ceiling (attic) insulation is a phenomenal R-70. Even the foundation is insulated to R-40 to prevent heat from being drawn out of the house into the cooler ground. "We're using insulated concrete forms for the basement wall that has a total of eight inches of expanded polystyrene foam insulation," said Hoberecht. "We're also using eight inches of expanded polystyrene foam insulation underneath the basement floor slab."

No thermal bridges

But wait, there's more. Insulation *per se* is only one factor in stopping heat loss. "You absolutely must eliminate

Image source: Krapmeier & Drössler 2001, *www.harvestbuild.com/passive.html.* See CEPHEUS: Living Comfort without Heating,´by Helmut Krapmeier and Eckart Drössler, Springer, 2001



thermal bridges," Hoberecht declared. "You must make sure that no wood member goes all the way through an external wall—otherwise the wood stud conducts heat around the insulation and outdoors." Thermal bridging is likely one reason that blowing insulation between the existing studs of my house resulted in only a 25-percent reduction in my heating bill. To avoid thermal bridging, passive houses commonly have double-stud walls—two parallel walls separated by a gap of several inches that is also filled with insulation.

Airtight construction

As anyone living in a charming older house knows all too well, drafty construction brings a double-whammy in winter: it lets in cold air (which you must now pay to heat) and lets out warm air (which you've already paid to heat). Drafts are worst around places where windows and doors are set into walls, electrical sockets and window-unit air conditioners are mounted to outside walls, and vents in the kitchen, bathrooms, and laundry room exist to the outdoors.

In a passive house, all plywood joints are sealed with building tape. Architect Katrin Klingenberg, executive director of the Passive House Institute US (PHIUS) in Urbana, IL, founded in 2007, originally went so far as to eliminate all electrical sockets on exterior walls, but has since figured out how to include the exterior electrical sockets and still maintain an effective air barrier. "Yes, the initial cost is 10 to 20 percent more than standard high-quality construction for the super-insulation, the double-stud construction, and the extra attention to detail required for air-tight construction," Hoberecht acknowledged. "But the energy bill of a passive house is so low that the payback period should be under 10 years, depending on the cost of fossil fuels."

Insulated windows and doors

In Europe, the outer doors themselves are well insulated and may be more than three inches thick. Furthermore, "the seals are tremendous," Hoberecht said. "It's like opening a door on a commercial freezer."

The windows for passive houses are triple-pane, yielding R-values as high as R-11 for the glass—better than the *walls* of many existing homes. "Another key for these windows is warm-edge spacers," Hoberecht continued, referring to the edging structures that separate and hold the parallel panes of glass apart and seal in argon gas between them. "The frames are also very well-insulated, some with cork in the middle to eliminate thermal bridges." As a result, the window frames can be as high as R-8 or R-9. For comparison, a typical double-pane window (perhaps like the ones installed 10 years ago in my house) is probably R-4 or R-5 for the glass and only R-2 or R-3 for the frame.

Moreover, the new triple-pane window glass has thin-film coatings to maximize solar heat gain (admit maximal sunlight) in winter; in summer, awnings above the windows can shade them from the much higher-altitude sun. And yes, the windows can be opened when outdoor temperatures are pleasant; the European tilt-turn design allows the window either to be cranked open like a casement window or tilted inward at the top (to avoid letting rain blow inside).[13]

"Adequate windows are not yet widely manufactured in the United States," said Hoberecht, "so for the PNC SmartHome Cleveland we chose to order them from Germany to highlight their outstanding performance." They cost about $100 per square foot, or about $1,000 for a window the size of a standard sash window. The windows and doors in the 3,000-square-foot PNC SmartHome alone cost $50,000, probably double that of high-quality conventional windows and doors. However, "costs should decline as U.S. manufacturers climb on board and we don't have to pay for exchange rates or shipping from Europe," Hoberecht predicted. Moreover, as with any technology, costs should decline as demand rises, and payback time will depend on the future cost of fossil fuels.

Excellent ventilation

Despite the airtight construction, passive homes are designed to be thoroughly ventilated by outdoor air—just in a controlled way that allows heat energy to be reclaimed, not by random drafts. The air is exchanged by an energy recovery ventilator, which is designed to operate at low speed 24/7 year-round to exchange 40 percent of the air volume of the house each hour—enough to ensure no buildup of moisture or volatile organic compounds that may be outgassed by carpets, furniture, or plastics. With some units, the air may be filtered to HEPA standards, removing pollens, dusts, bacteria, and mold spores.

Passive houses generally have no separate kitchen or bath fans—to minimize penetrations through the building envelope and to guarantee heat exchange with any exhausted air. Stale air from the kitchen/baths/laundry is

exhausted out, and fresh filtered air is supplied to the bedrooms and living areas. According to the Passive House Institute US, "studies have shown most people do not ventilate their home as they should. ...Regular home owners should open their windows every two hours for two minutes to ventilate properly (including night hours)."[14] Thus, the continuous ventilation in a passive house can result in indoor air quality higher than that in a conventional home.

The exhaust air exchanges its heat with the incoming air on its way out. In the winter, warm exhaust air is run by the cold intake air in the energy recovery ventilator to reclaim as much as 95 percent of the heat energy. "Exhaust air at 70°F preheats incoming air to 67°F," explained Hoberecht, "reducing the amount of additional energy needed to boost it to 70°F. Range hoods are typically of the recirculating type using charcoal filters."

In dryer central Europe, the air may be run through earth-warming tubes to further pre-warm it (or pre-cool it in summer) to ground temperature near 50°F. In a humid climate like Cleveland's, "a better approach is to use a loop of PEX tubing filled with a glycol solution that is placed around the foundation of the house or under the slab," said Hoberecht. "Using a very small pump, this solution is pumped through a heat exchanger, effectively pre-heating the incoming air in the winter and pre-cooling it in the summer."

Heating with a hair dryer

Although a passive house has no conventional furnace, it may have a small supplemental heat source for colder climates. Most U.S. passive houses use a ductless "mini-split"—a wall-mounted unit with a condenser outdoors and an air handler inside. "These new ductless mini-split units are far more efficient than the old-style heat pumps," Hoberecht said. "Even with external temperatures below zero [Fahrenheit], they can still produce heat. In the summer, they cool and dehumidify the air and are nearly twice as efficient as traditional air conditioners. And you barely hear them."

The heating standard of 15kWh/m^2/yr is a total requirement for the whole year—more in winter, less in spring and fall, and nothing in summer. The peak heating requirement of 10 W/m^2 on the coldest winter day "translates into about 1 W/ft^2, so a 1,500-ft^2 house would need the equivalent of a single handheld hair dryer," Hoberecht said. "A larger house would need a second one."

The bottom line

Some 25,000 European households are one thing. How do American families respond to the idea of passive houses?

Since 2003, Klingenberg and co-director Mike Kernagis have been offering education, consulting, and research across the U.S. and Canada, first as E-Co Lab in Urbana and since 2007 through PHIUS. "We have made great progress to transfer the European experience back to the North American climate zones, identifying and encouraging an impressively growing market," Klingenberg said. "We have trained over 400 certified consultants and have over 100 passive-house units in all U.S. climate zones in our certification program." Along with a third author, Mary James, Klingenberg and Kernagis have written the book *Homes for a Changing Climate: Passive Houses in the U.S.*[15]

And individual builders are getting the word. For example, Andrew R. Kline and Alex Melamed co-founded Green Generation Building in 2009 in Yellow Springs, OH. With mechanical engineering professor and PHIUS-certified passive house consultant Eric Lang, Kline and Melamed designed and built an 1,800-square-foot passive house in Yellow Springs. They had no client; they raised the financing and built the house on speculation as a learning exercise as well as a demonstration of their craftsmanship. Before the house was even completed last November (2010), Green Generation had a buyer—even though the actual cost of the house was significantly higher than a typical home price in the town.

This past February (2011), the house proved the soundness of super-insulation and air-tight construction in retaining heat. "A severe ice storm knocked out power in southwest Ohio for more than a day and plunged temperatures into single digits," Kline recounted. "Even though it knocked out lighting, ventilation, and supplemental heating in the passive house, after 24 hours the interior temperature was still above 62°F." For comparison, when my furnace died during an 18°F cold snap three years ago, in 12 hours the interior temperature of my 1914 then-uninsulated house plummeted to 27°F. It was literally warmer inside my refrigerator (45°F) than it was in my kitchen.

I'm actively ready to go passive.

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1. Details about the PNC SmartHome Cleveland are at *www.cmnh.org/site/atthemuseum/onexhibit/smarthome.aspx.*, including a video with the passive-house consultant and committee. In September 2011, the house will be moved to a permanent site a mile away and offered for sale. Engineering details and photographs of the Passive House in the Woods in Wisconsin are at *www.passivehouseinthewoods.com/the-house/*.

2. The Passivhaus Institut (Passive House Institute) in Darmstadt, Germany, has an English-language web page *www.passiv.de/07_eng/index_e.html* as well as a Wikipedia-style reference—the Passipedia (*passipedia.passiv.de/passipedia_en/passipedia_a-z*). Detailed pages of engineering specifications and data include measurements of the comfort of passive homes (*www.passivhaustagung.de/passive_house_e/comfort_passive_house.htm* and *www.passivhaustagung.de/kran/first_passive_house_kranichstein_en.html*). In North America, see the Passive House Institute U.S. *www.passivehouse.us/passivehouse/phiushome.html*) and the Canadian Passive House Institute (*www.passivehouse.ca/*).

3. Although not all the passive houses in North America have been officially certified by the Passivhaus Institut, several have been featured in newspaper and magazine articles, including in *The New York Times, Fine Homebuilder, Ottawa Magazine, Dwell*

Photos pp. 20-21: Corey Gaffer (gafferphotography.com)

(magazine), (see links at *www.passivehouse.us/passivehouse/articles.html*). The Canadian Passive House Institute site has many construction photographs.

4. "What is a Passive House?" *www.passiv.de/English/passiveh.htm*.

5. Latest statistics from 2009 are summarized in the Residential Energy Consumption Survey, U.S. Energy Information Agency at *www.eia.doe.gov/consumption/residential/*.

6. EIA statistics are displayed in charts compiled by Architecture 2030 at *http://architecture2030.org/the_problem/problem_energy*.

7. McKinsey Global Institute, "Curbing Global Energy Demand Growth: The Energy Productivity Opportunity—Residential Sector," McKinsey & Co., May 2007, *www.mckinsey.com/mgi/reports/pdfs/curbing_global_energy/mgi_curbing_global_energy_chapter_3.pdf*.

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9. The EIA estimates $201 billion per year and includes allowance for warmer climatic zones. Energy Information Agency, "2005 Residential Energy Consumption Survey: Energy Consumption and Expenditures Tables," Table US1. Total Energy Consumption, Expenditures, and Intensities, 2005, Part 1: Housing Unit Characteristics and Energy Usage Indicators, *www.eia.doe.gov/emeu/recs/recs2005/c&e/summary/pdf/tableus1part1.pdf*.

10. In "Low energy buildings—scientific trends and developments," Patrik Rohdin, Wiktoria Glad, and Jenny Palm surveyed and categorized the past two decades of literature; the article appears as Chapter 6 of *Energy Efficiency*, edited by Jenny Palm, InTech, August 2010 (*www.intechopen.com/articles/show/title/low-energy-buildings-scientific-trends-and-developments*).

11. U.S. Department of Energy, "Insulation Fact Sheet," DOE/CE-0180 2008, *www.ornl.gov/sci/roofs+walls/insulation/ins_05.html* .

12. I didn't just happen to interview the four wrong guys. According to Passivhaus Institut founder Wolfgang Feist, "...[M]ost builders I have talked with in North America still think that increasing insulation is an expensive thing... I'm surprised, because [over the lifetime of home-ownership] insulation is the cheapest thing you can do." Quoted in the article "An Interview With Wolfgang Feist," Energy Design Update 28 (1): 6, January 2008, *www.passivehouse.us/passivehouse/articles_files/edu%20jan%2008.pdf*.

13. For more about window design, see Frans Freundorfer, Berthold Kaufmann, and Markus John, "Passive House windows completely redesigned," Working Group V: Research and development news, presented at the 13th International Passive House Conference, April 2009.

14. Frequently Asked Questions, Passive House Institute US *www.passivehouse.us/passivehouse/faq.html*. This page also addresses concerns about radon gas.

15. Katrin Klingenberg, Mike Kernagis, and Mary James, *Homes for a Changing Climate: Passive Houses in the U.S.*, *www.passivehouse.us/passivehouse/passivehousebook.html*. Mary James has also written *Recreating the American Home: the Passive House Approach.*

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Pump prices on March 28, 2011, in Furnace Creek, CA. Photo: T.E. Bell

MindSET Grants

❁ Michigan Gamma ❁

This year, TBΠ's Michigan Gamma Chapter (University of Michigan) has developed a partnership with three elementary schools from the Ann Arbor public school district.

Four MindSET activity sessions were hosted during this period. On average, more than 50 K-12 students, 25 TBΠ member-volunteers, and two elementary school teachers participated. The modules used during these sessions were bridges, mousetrap cars, water-bottle rockets, and circuits.

Lectures on math and science concepts along with take-home worksheets preceeded each hands-on activity module. Students received certificates of participation and special recognition for winning a contest during a module.

In future semesters, a 30-minute aptitude test will be developed and administered to students before and after MindSET sessions during a semester to measure the progress and impact of MindSET.

During the Winter 2011 semester, Michigan Gamma hosted three modules. Additionally, a teacher-training session is being organized for the fall semester, with parent-training sessions to be scheduled and offered periodically throughout the year.

The mousetrap car, water-bottle rocket, and circuit modules were modified and adapted to facilitate better student learning. These modified worksheets and new presentations will be submitted to the leadership team before summer to adapt for use by other chapters.

Funding was provided by TBΠ to purchase materials and supplies for the winter semester. Corporate funding was obtained from Chevron Inc. for the Fall 2011 semester. Part of this funding will be directed toward efforts to create a new module in energy and environmental engineering for Summer 2011.

—**Sarang D. Supekar,** Michigan Gamma Advisor and MindSET Chair

❁ New York Tau ❁

During the Spring 2011 semester, the New York Tau Chapter at Binghamton University hosted two MindSET activity sessions with sixth-grade students from Ann G. McGuinness Intermediate School.

The mousetrap car module was presented in February. This MindSET module allows K-12 students to learn about energy, force, and velocity while building and testing their own mousetrap cars.

The second module was hosted in April, and participating students built ultra-simple electric generators using basic materials and a magnet. This activity was a wild success with the kids. Their interest was sparked even before the actual activity when the prototype generators were shown to their teacher.

The school contacted local media about the MindSET partnership, and WBNG-TV produced a short feature. In addition, information and pictures from the second activity have been posted on the school district's website.

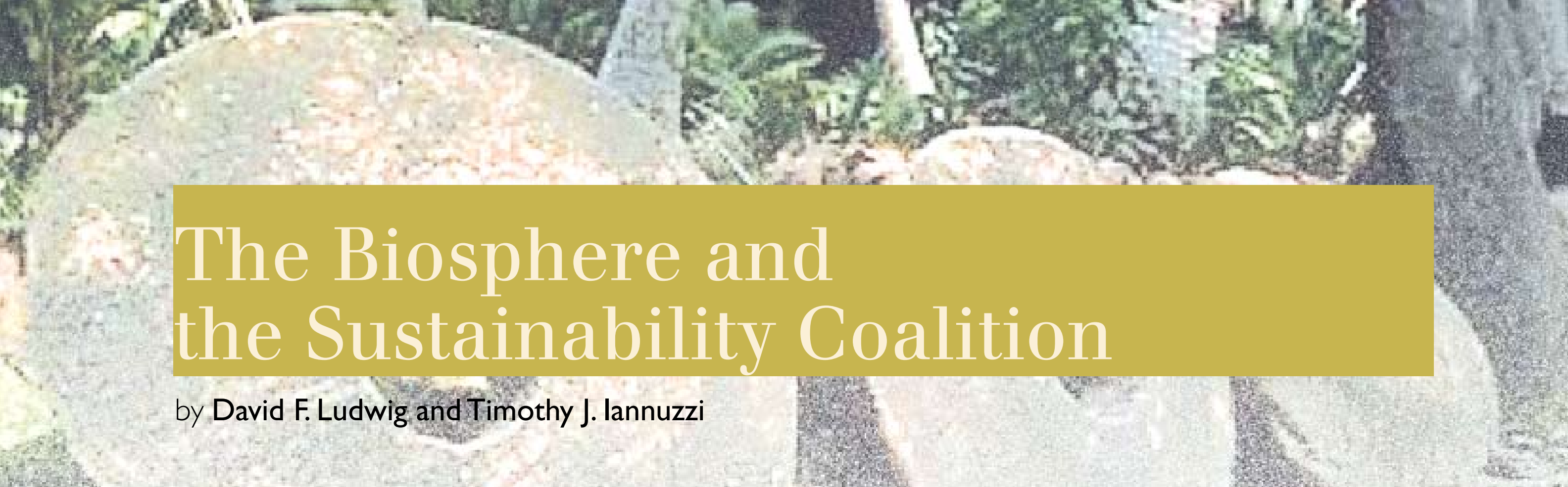
The superintendent of the Endicott school district is very enthusiastic about the program in general and noted that the timing would give it particular importance, because the district was in a debate with the state over millions of dollars of budget cuts—particularly in the technology department.

In our chapter's recent officer election, I was re-elected to my position as MindSET coordinator and look forward to expanding and improving the program for next year. Instead of holding the activities during the school day in one class, our plan is to expand the program and hold activities after school.

This will allow us to reach more students and make it easier for TBΠ member-volunteers to participate. Discussions are underway with the superintendent, and our next step is to present the MindSET Program to the school's parent-teacher association. The PTA meeting will provide a valuable opportunity to share information about the program, to gage interest, and to gain the support of the teachers and parents.

So far the majority of our funding has been supplied by TBΠ. As we move forward, our chapter will explore our own fund-raising options to offset costs. Working with K-12 students and teaching them math and science concepts has been a rewarding experience. Our NY Tau Chapter is proud to represent the MindSET Program in our state, and we look forward to its continued success.

—**John Rocchio,** New York Tau MindSET Coordinator



The Biosphere and the Sustainability Coalition

by David F. Ludwig and Timothy J. Iannuzzi

Money stones on one of the Yap islands.

Weapons were not the only products of the nuclear and thermonuclear bomb programs of World War II and the Cold War. Ironically, the entire field of systems ecology, which merged tool kits of biology and engineering, was an important, if serendipitous, outcome.

We owe the inheritors of our world our best and hardest work as we prepare to hand things over to them.

From a technical perspective, specific radioactive materials entered the environment during the development and deployment of atomic weapons. These compounds acted as *radiotracers*—they could be tracked from environmental media to organisms and back again. Known half-lives and biochemical behaviors allowed quantification of biological processes that were intractable until that time. This allowed biologists to step back from organisms, populations of organisms, and communities of populations and view the biological hierarchy as a coherent, functional system. The term *ecosystem*, coined in the 1930s, referred to the relationships of organisms and their physical and chemical environments.[1] By the 1950s, however, it was clear that there was a meaningful hierarchy of patterns and processes in the living world (subcellular organelles, cells, individual organisms, populations, communities, biomes) analogous to that in the physical/chemical world and that *ecosystems* had broader meaning and many more dimensions than initially thought. Brothers Eugene P. and Howard T. Odum published a most important book that illustrated the workings of ecological systems.[2]

Rachel Carson (1907-64) wrote *Silent Spring*, showing that human behavior, well-being, and economics were integral components of ecosystems.

The Roots of Systems Ecology

The realization that ecosystems had an underlying reality that could be applied to understanding the living world brought debate among ecologists. Until the Odum's book was published, *ecologists* were specialized in subfields—animal or plant ecologists, limnologists (fresh water) or marine biologists, herpetologists (reptiles and amphibians) or mammalogists. Ecologists were suddenly thrown into a world where deconstructing biology into its component parts was inadequate experimental design. Tools were needed to evaluate whole systems—ecosystems—as functional interactive systems. Those tools were fortuitously becoming available as an outcome of nuclear weapons programs.

A key was the understanding that the laws of physics applied not just generally to living systems, but they applied very specifically and could be used to quantify relationships among the components of living systems at any scale. Until this time, the science of ecology was conducted primarily by counting. How many organisms of what species are present in what spatial area of a certain habitat? As habitats change with time[3], how do the numbers of species change? Which species drop out of the counts; which ones appear? Through the 1940s, botanists and zoologists who *did* ecology did it by enumeration.[4]

In the new world of systems ecology, we added calorimetry—measurement of energy content—to our toolbox. By accounting for the thermodynamic laws, we could now track the flux of energy through the ecosystem, from the sun to plants to herbivores to carnivores. Now we could understand, as one author put it, "why big fierce animals are rare."[5] In large part it is because energy transfer is inefficient. To get from plants to large carnivores, roughly 50-to-90 percent of the energy present at each level in the food web is lost to the level above. Physics constrains biology in fundamental ways.

When ecologists turned their attention to whole systems, exploring the transformations of radioactive tracers, they realized that there was another aspect of biological patterns and processes *missing* from their interpretations. This was the human element. By the 1960s, it was becoming clear that human beings affected and were affected by ecosystem interactions. A most familiar example was published by Rachel Carson in 1961—*Silent Spring*. It built on the methodologies developed by systems ecologists, but it traced the pesticide DDT (and related molecules) through ecosystems and warned of potential effects of widescale and long-term applications. The book was important, not only because of its innovative application of ecosystems thinking. Carson's work (in this and other books[6]) showed that human behavior, well-being, and economics were integral components of ecosystems. This came as something of a shock to reductionist scientists just learning to deal with whole systems outcomes.

Interdisciplinary Origins

We should have seen it coming. The word *ecology* comes to us from the Greek *oikos*—meaning house, after the

Indo-European *weik*—with implications of clan, village, and vicinity. *Logia* is from the Greek via German—*study*. The word *economy* is from the same root *oikos*, with *nomos*—management, via Indo-European *nem*—to assign or allot.[7] In effect, ecology and economics are closely related concepts, the former the study of and the latter the management of, the *oikos*—the biosphere.

Some ecologists (the Odum brothers, their students, and colleagues were among the leaders) understood the importance of humans, economic beings, in the living world where money and its flux and transformation were otherwise meaningless. Attempts were made, and are still being made, to understand outcomes of the *nomos* for the *logos* of the system.[8] But it has proven difficult to find tools that allow us to understand quantitatively what we can see plainly qualitatively—that money changes things.

Why might this be? After all, systems ecology can account for the quantitative effect on, say, energy flow, of the information content of an ecosystem. For example, systems with a lot of biological information—very diverse ecosystems—have energy-flux profiles that differ from those with less information—say, agronomic monocultures. But we have not had the same success in understanding money in this context.

Part of the problem is that it is difficult for non-economists to understand what money actually IS.[9] In our classes, we illustrate this conundrum via the *money stones* of the Yap Archipelago in the Pacific. On these tiny islands are a number of large, heavy stones, cut into various sizes of rock *donuts*. This stone is not available on Yap. The quarries are on other islands far to the west. Somehow, using ocean-going canoes, the Yapese cut these stones and transported them over hundreds of miles of open water (when I teach this, I can't help but muse over how many stones—and canoes and canoe crews—were lost in process) and placed them in prominent public spaces on the main island. These stones became a form of currency. A rather abstract form, for sure. On Yap, you might own a portion of a money stone. Say, you own a quarter radius of one of the stones. There are no marks on the stone to indicate who owns what, it is common knowledge. Now you need a dowry for a daughter's long-planned wedding. You can bargain a segment of your segment, or your entire segment, as payment for the food, drink, and other festivities and another portion for the dowry itself. If you serve chicken, the farmer who provides the chickens takes ownership of an appropriate-sized piece of your piece, of the stone—and can use that piece, in turn, to purchase more chicks to raise.

President Dwight D. Eisenhower, warned of the dangers of a military industrial complex.

But here's the thing. These stones are big and heavy. You don't move one just because you own some or all of it. It stays where it is, and knowing who owns how much of which stone or stones is part of the culture. Notice that no energy is transformed or transferred in money stone transactions. You simply own a piece of stone, and you can pay someone with your piece of stone, which they will now own.

Yet the transaction—the payment-for-purchase—has a large impact on the ecosystem. You've purchased a flock of chickens. These chickens are cooked and served, so the farmer needs more chicks, and he needs food and water for the new flock, plus a place to recycle or dispose of wastes. Compiling those things alters the environment in response to money changing hands. Except it never actually *changes hands*. It just sits there, same place, new owner.

This strikes us odd. In our transactions, *something* changes hands. Cash, a check, a credit card, or a credit card number. So there is some flux of matter and energy in non-money-stone transactions, although it has clearly been reduced in recent years with the advancement of electronic transfers over paper transactions.[10] But the energy content of a credit-card transaction, while non-zero, is nonetheless very low relative to the ecological outcome of the economic activity—and certainly not proportional. The amount of energy that goes into producing, circulating, and spending $1,000 to purchase, say, a case of very high-end Bordeaux red wine is a result and cause of massive environmental changes. The vine pruning, fertilizing, weed control, disease control, harvest, and production of the wine from pressing the fruit through bottling and sale take an enormous amount of energy in many forms: diesel-tractor fuel, basketry from harvested reeds, the calories people expend in harvest and production, and the metals and polymer parts of the pressing and fermentation infrastructure. That $1,000 generates big environmental changes.

Did we mention engineering? Much of what links economic processes to environmental outcomes is engineering. In our example, you will need engineers to design, build, and maintain the presses and vats, the conformation of the vineyard land, irrigation systems, and the vehicles that get the wines to market and that haul fertilizers and fungicides. In this model, engineering enables economics to be linked to ecology with direct affects on the ecosystem. And thus it is a crucial aspect, a focal point, of human interaction with the environment. So, for much of our interface with the rest of the world, it is a loose collaboration of engineers, economists, and ecologists who design, produce, operate, and manage things.

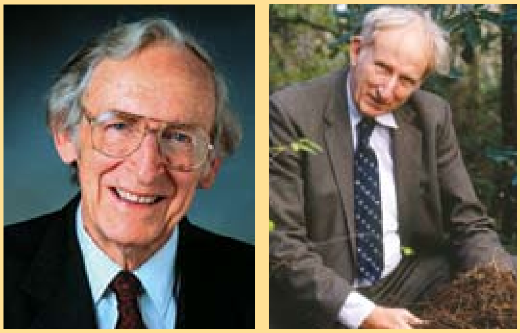
Ike's Insight

But things have not been and are not so loosely linked in some contexts. In January 1961, Dwight D. Eisenhower used his last presidential address to warn of the consequences of a *Military-Industrial Complex* that he believed had risen in the U.S. in the wake of World War II.[11] From the perspective of holistic systems analysis, the MIC itself is an example of a self-organizing hierarchical open system. Inputs to the MIC include needs specifications and purchase orders (technical engineering information), money (economic information), and labor and materials (human and natural resources). The MIC infrastructure churns money, materials, and information into product outputs. By having components of the

MIC system itself flow both to and from the larger matrix of society in the form of personnel, strategic policy, tactical developments, the MIC helps assure that its environment is favorable for its own stability and growth.

Self-Organization is a Key

Self-organization and environmental modification are key properties of successful biological systems. True ecosystems exist at many temporal and spatial scales. There is a tendency to think of *ecosystem* as landscape-level phenomena, but any organized system with a *skin* or *membrane* recognizably constraining internal vs. external processes can be thought of as an ecosystem. In the heyday of systems ecology, roughly the 1960s through 1980s, endless beer-and-pizza debates were devoted to ecosystem definitions and scale, similar to (and as productive as) Renaissance theological debates about angels fitting on heads of pins. What emerged from graduate-school indigestion, though, was a useful and practical definition. An ecosystem was self-organized inside a recognizable membrane such that processes occurring inside and outside the membrane were more active than processes operating through the membrane. And the most successful ecosystems monitored their own immediate environs and modified it when necessary and when possible by sending signals of matter, energy, and information across the membrane into the larger world.[12]



Brothers **Eugene,** left, and **Howard Odum** published a book that illustrated the workings of ecological systems.

Careful parsing of the previous paragraph suggests that the ability of a system to modify its own environment is a real key to persistence. Bacteria, both pathogens and free-living forms, are masters at this. Microbial films are formed by cellular exudates, which link the cells to the substrate, and which develop over time, becoming more functionally active and complex. The self-organized bacterial cells in turn organize their environment in favorable ways, maximizing the stability and persistence of the whole system.[13]

At this point, it is obvious that organisms possessing technology and engineering, and with matter and energy surpluses that can be converted to environmental investment (that is, economics), should be most able to modify their matrix and persist. A few animals act as environmental engineers—beavers build dams and winter housing, and mole-rats create spectacular specialized tunnel systems and harvest their food sustainably.[14] Some ants and termites create massive infrastructure, and harvester or leaf-cutter ants operate complex and persistent agricultural systems.[15]

Technology Rules

But nobody does it like we humans do. Our awesome technological abilities, highly-developed economies, and ability to anticipate and plan for the future have taken us well over the threshold of environmental modification —a process that began very early in our history. The entire biosphere is now under our control, whether we like it or not.[16] To date, beginning in the Pleistocene Epoch, we have managed the biosphere by default[17]—which has led us, in general, to trouble. "Awesome technological abilities" applied without careful, comprehensive, and adaptive planning are not a recipe for success. Nor, however, are they a recipe for disaster.

Some definitions may be helpful now. In one sense, we can simply define successful environmental management as the persistence of human beings in the biosphere. But this is not a very satisfying or useful definition. After all, humans can survive in very difficult environments. If we say that persistence is one element we need to consider, but that quality-of-life or habitat quality is similarly important, we start to see where we need to go. The goal is not survival alone. It is survival at a reasonable standard of quality. We can call this broader standard of success *sustainability*. A sustainable biosphere allows humans not only to survive, but to prosper. This is indeed a more difficult objective for our species. But it is imperative if we are to leave our children and their children and generations to come with a world worth inhabiting.

We have, in fact, made considerable headway in not only preserving the future of human life, but maintaining a reasonable level of environmental quality. In the developed world, environmental regulations analogous to the U.S. Clean Air Act, Clean Water Act, Comprehensive Environmental Responsibility, Cleanup, and Liability Act, and Resource Conservation and Recovery Act have substantively improved the quality of our collective habitat. International regulations such as the United Nations Compensation Commission and the Migratory Bird Treaty have helped us advance further. Even in the developing world, where the standard of success is of necessity weighted to survival and persistence as the first priority, environmental quality is generally improving. We have made enormous strides in sustainability since the 1950s.[18]

To some extent, we've hit a wall in our ongoing efforts to improve and maintain a sustainable biosphere. We focused enormous effort and infrastructure on reducing and controlling environmental releases of toxic industrial chemicals. This made considerable sense, as Rachel Carson told us in 1961. However, in the process of controlling such chemicals, the environmental management system that we built, incorporating regulators, policymakers, planners, scientists, environmental and civil engineers, and enforcement specialists, has taken on its own life and forward momentum. We continue to pursue and *manage* industrial chemicals in the biosphere despite having largely solved that particular problem. The *team* of regulators *et al.* has largely done its

job. This is not to say there are not still chemical threats to the environment. There are many, and they are more intense in the developing world. However, on a relative scale, as a society, we have generally succeeded in managing industrial chemicals.

And, while we were accomplishing that worthy objective, we found ourselves as a society more interested, in recent decades, in other levels in the biological hierarchy than the ecosystem. Biotechnology and nanotechnology have largely taken pride-of-place at the interface of humankind and the biosphere. To a degree, the field of *systems ecology* doesn't exist any longer as a free-standing discipline. Funding, both commercial and public research money, flows to biotech and nanotech investigators. The interdisciplinary nature of systems ecology, one of its strengths, has lost its reason-for-being as we've found it more profitable and interesting to merge chemistry, physics, engineering, and biology at the molecular scale rather than the landscape. But the fact that we've taken our eyes off the ecosystem ball doesn't mean the game is won.

The Legacy: Our Kid's World

The environmental problems that we are handing to our children and theirs are no longer primarily those of uncontrolled chemical releases. Our successes in that arena have let other issues emerge and gain importance. Potable water, nutrient (fertilizer) pollutants, biodiversity, habitat quantity and quality, safe and sufficient food, soil quality and quantity, and an array of potential impacts associated with climate change (including the spread of disease organisms for humans and domesticated animals and plants) are the real issues now. But the teams we built to manage chemical pollution are having a tough time coming to grips with these shifting priorities. The process of managing toxic chemicals is basically (in an abstract *best case*) one of science-driven regulation and subsequent enforcement. That model may be insufficient for the immediate future of the biosphere.

For example, consider the city of Calcutta (or Kolkata), India. In the 1800s, municipal waste was deposited on the eastern boundary of the urban area. Over time, people learned to sort the garbage to recover recyclables, compost organic materials, and farm vegetables on what was (and is) essentially a landfill. In the first half of the 20th century, sewage and surface water (stormflow) were combined and outfalls run to the east of the city. Vegetable farmers took advantage of the water supply to supplement field fertility, and a proportion of the water was run into a sequence of aquaculture ponds. Pond effluent is used for downgradient paddy farming and also taken back to the upgradient vegetable gardens. This tightly integrated and highly effective recycling system has been producing substantive quantities of fish and vegetables for decades. The produce is sold in wholesale markets within the 12,000 hectare area serving the operation, and also in the city itself. All is sold fresh, within hours of harvest.

The Calcutta Waste Wetlands ecosystem was formed, developed, and maintained by combined cultures of the people-in-place. It is not a legislated, protected, or subsidized special operations zone (although it was recently protected as a United Nations RAMSAR site). Land ownership has varied with time, and for a period absentee speculators purchased and combined much of the area, but apparently it has more recently been returned to largely smallholders. The local cooperation among farmers, aquaculturists, economists, engineers, entrepreneurs, scientists, and technologists is maintained only informally. In other words, the *team* that solved the coupled problems of solid and liquid waste management for the enormous city of Calcutta came together of its own will and successfully addressed many issues where more formal interdisciplinary management efforts have failed.[19]

This is not to say there aren't ongoing problems and issues of safety, public health, economic fairness, efficiency, and others arising daily. Such issues are constant, and among them is the ever-present pressure on the land from urban expansion, along with the fact that only a portion of the total wastewater flow from the city is used in the waste-wetlands system, the remainder being released as raw combined sewer flow to the estuary. The important lessons of the Calcutta system are in the collective nature of the problem-solving effort and the on-the-ground accomplishments of flexible and adaptable interdisciplinary webs of relationships.

The latter is a particularly important point if we think back to where we started this essay. The Manhattan Project was an unprecedented and rigorously formal collaboration among physicists, chemists, and engineers involving government, academic institutions, and commercial corporations. The importance of the private sector grew between the World Wars, and it was natural at the start of WW II in the U.S. to include companies as integral to the weapons design and production efforts. Academia provided much of the intellect, and government provided the impetus and the muscle to get the job done, partly in the form of investment and partly via military necessity.

The far-less-formal collaborations that developed and operate the Calcutta Wastewater Wetlands system are similarly multidisciplinary. One reason that success has not repeated itself may well be that it is unique. The informality of the process means it was truly spontaneous, so that *managing* to produce such a cooperative enterprise is a major challenge.

Perhaps we need to leverage the best aspects of the formal—Manhattan Project—and informal—Calcutta—models of interdisciplinary collaboration. The emerging environmental problems, those that we are leaving for our kids to deal with, are inherently complex. Solving those

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problems will require innovation and action across scales of hierarchy and among many technical disciplines. Our experience as investigators of complex urbanized ecosystems demonstrates that scientists, engineers, and economists can cooperate successfully.[20] It shows that stakeholders across a spectrum of interests—the private sector, government, academia, and consulting enterprises—can join to get things done that would be impossible for any one or two sectors to handle alone. If we are going to manage our environment by design and not by default, and at the large scale and small reflecting the range of our impact, it is important that we innovate and collaborate. Effective interdisciplinary collaboration, as demonstrated by both the Manhattan Project and the Calcutta Wastewater Wetlands, can yield even more effective innovation. There is no *code* needed.

We are talking about the Sustainable Biosphere Project, in a matrix where scientists bring the data, engineers bring the actions, and economists bring investments, and the table that all this is heaped on is occupied by regulators, industrial experts, academics, and consultants. We owe the inheritors of our world our best and hardest work as we prepare to hand things over to them.

Notes

1. Arthur Tansley is generally credited with the concept and the word, in Tansley, 1935, "The Use and Abuse of Vegetational Concepts and Terms," *Ecology* 16:284-307.

2. E.P. and H.T. Odum, 1953, *Fundamentals of Ecology*. The Odum's concept of holistic ecology was greatly supported by Lindemann, R.L., 1942, "The Trophic-Dynamic Aspect of Ecology," *Ecology* 23:399-418.

3. The process of change-over-time is known as ecological succession, where one recognizable habitat replaces another in sequential, orderly fashion unless the system trajectory is upset or re-set by outside influences (such as human development). The processes of succession continue after such impacts, but the pathway is changed.

4. This is a gross over-simplification of the then state-of-the-science of ecology, but, in concept, is not far off. E.g., some evolutionary ecologists studied changes in organisms with habitat changes. Even that exercise involved enumeration; as in "how many fin spines does fish species A have in habitat B vs. habitat C"?

5. Colinveaux, P. 1979. *Why Big Fierce Animals are Rare*. Princeton University Press.

6. Among other works, Carson published *The Sea Around Us* and *The Edge of the Sea*, both emphasizing her perspectives on human interactions with the biosphere. See *www.rachelcarson.org*.

7. The etymology is from *The American Heritage Dictionary of the English Language*, third edition, 1992, Houghton Mifflin Company.

8. An excellent and innovative introduction to this and other ideas is Vermeij, G.J. 2004. *Nature: An Economic History*. Princeton University Press.

9. Economists are also far down the learning curve, but their field has terminology and grammar allowing it to sound like it knows what's going on. Whether that understanding is reflected in the understanding of functions in the *real world* remains an open question.

10. The money stones are now more of tourist thing, but some retain ceremonial transfer of wealth via money-stone apportioning.

11. There are many sources providing video, text, and analyses of Eisenhower's speech. An interesting perspective is available at *www.sourcewatch.org/index.php?title=military-industrial_complex*, which cites the film *Why We Fight* as a source.

12. Much theoretical ecology literature is devoted to this subject. Most interesting are Conrad, M. 1983, *Adaptability: the Significance of Variability from Molecule to Ecosystem*, Plenum Press, NY; and Higashi, M. and T.P. Burns (eds) 1991, *Theoretical Studies of Ecosystems: the Network Perspective*, Cambridge University Press, Cambridge.

13. See Page, W.J. and W.G. Martin, 1978. "Survival of microbial films in the microwave oven." *Can. J. Microbiol.* 24:141-143.

14. Many sources available. Nowak, R.M. and J.L. Paradiso 1983, *Walker's Mammals of the World*, Johns Hopkins University Press (4th edition] is complete and accessible to nonspecialists.

15. Referring to Gordon, D. 1999, *Ants at Work: How an Insect Society is Organized*, The Free Press, NY; and Helldobler, B. and E.O. Wilson 2009 *The Superorganism: The Beauty, Elegance, and Strangeness of Insect Societies*, W.W. Norton & Company, NY.

16. Environmental groups, some academics, and policy shops believe that "you can't fool with Mother Nature" and "Nature is in charge"; e.g., *www.greenpeace.org/international*. But we have fooled with nature, which is no longer solely in charge, even if she retains some of the threads of power. The fact of climate change alone should be sufficient to quell this argument, although it has yet to do so.

17. While there remain holdouts for a more *politically correct* view that human beings were not primarily responsible for the Pleistocene extinction of numerous species of mammals and birds in the Americas, Australia, and New Zealand, the evidence is in fact overwhelming, see *Twilight of the Mammoths: Ice Age Extinctions and the Rewilding of America* by Paul S. Martin, University of California Press 2005.

18. Our belief in improving environmental quality is not shared universally. Many non-governmental organizations, policy shops, and individuals have a deep stake in environmental pessimism or optimism and make little allowance for evidence from the alternative perspective. Reliable sources summarizing the state of the environment with a little more objectivity are McNeill, J.R. 2000, *Something New Under the Sun*, W.W. Norton & Company, NY; and Goudie, A. 2000, *The Human Impact on the Natural Environment*, MIT Press, Cambridge, MA. Expositions of the state-of-the-environment can be found in Lomborg, B. 2010, *Cool It: The Skeptical Environmentalist's Guide to Global Warming*, Vintage Books, NY; and Friel 2010, *The Lomborg Deception: Setting the Record Straight About Global Warming*, Yale University Press, New Haven. Our work reconstructing the environmental history of the urbanized Passaic River, NJ, provides detailed documentation of the environmental degradation, improvement, and still-to-do of a specific ecosystem and has been expanded to include other urban rivers. Entry to these can be gained via recent articles and books: Ludwig, D.F. and T.J. Iannuzzi, 2005, "Incremental ecological exposure risks from contaminated sediments in an urban estuarine river," *Integrated Environmental Assessment and Management* 1:374-390; Iannuzzi, T.J. and D.F. Ludwig, "An interdisciplinary investigation of ecological history and environmental restoration objectives in an urban landscape," *Ecol. Restoration* 23:157-165; Iannuzzi, T.J., D.F. Ludwig, J.C. Kinnell, J.M. Wallin, W.H. Desvousges, and R.W. Dunford 2002, *A Common Tragedy: History of an Urban Waterway*. Amherst Scientific Publishers, Amherst, MA.

19. The Calcutta Wastewater Wetlands is evolving and adapting, but is not well documented in formal technical literature. The best approach to learning about this is to conduct your own web searches. Portals worth seeing include: *www.ecotippingpoints.org/our-stories/indepth/india-calcutta-wetland-wastewater-agriculture-fishpond.html* and *www.indiawaterportal.org/node/442*. An economic model of the system is: Bunting, S.W. 2007, "Confronting the realities of wastewater aquaculture in urban Kolkata with bioeconomic modeling," *Water Research* 41:499-505. A widely cited general review is: Ghosh, D. 1988. "Wastewater-Fed Aquaculture in the Wetlands of Calcutta–an Overview. Tomado de: Wastewater-Fed Aquaculture," *Proceedings of the International Seminar on Wastewater Reclamation and Reuse for Aquaculture*, Calcutta, India, 6-9 December 1988.

20. An economist who has a radical and innovative vision for environmental management is Jack M. Hollander. His 2004 book *The Real Environmental Crisis: Why Poverty, not Affluence, is the Environment's Number One Enemy*, University of California Press, should be read by everyone interested in a sustainable future.

Tau Beta Pi Names 156 Scholars for 2011-12

THE FELLOWSHIP BOARD announced the selection of 156 TBΠ Scholars from 377 applicants for senior-year study in the 2011-12 academic year. Scholarships of $1,000 or $2,000 are given to members on the competitive bases of scholarship, campus leadership and service, and promise of contributions to the engineering profession, with consideration given to economic need and academic commitment. This 13th group brings the total to 1,116 Scholars. Additional bios are posted on *www.tbp.org*.

The Nagel Scholarships are given in honor of former Secretary-Treasurer Emeritus R.H. Nagel, P.E., *NY Δ '39*.

The Record Scholarships are sponsored by Leroy E. Record, *KS A '29*, whose generous bequest in 2001 funded the Record Scholarship Fund to provide earnings for awards in perpetuity.

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The Dodson Scholarships are sponsored by Charles R. Dodson, *MD B '30*, who made a generous gift to TBΠ in 1998.

Ruth M. and Cleveland L. Campbell, P.E., *IA A '47*, made recent gifts to sponsor the Campbell Scholarships.

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The Kolff van Oosterwijk Scholarship is named for H.L.J. Kolff van Oosterwijk, *CA A '50*, who left a bequest in 2008.

The Michael R. Lindeburg, P.E., **Scholarships** are named for the president of Professional Publications, Inc.

George P. Mitchell, *TX Δ '40*, made a special gift to sponsor the Mitchell Scholarship.

The Spirit of Apollo Scholarship is given by a donor to honor the legacy of the U.S. NASA *Apollo* program.

The Baker Scholarship is named for 2010 Distinguished Alumnus—Merl Baker, Ph.D., P.E., *KY A '45*.

Christopher R. Dollarhide, *Nagel Scholar No. 36*

CHRISTOPHER IS A CHEMICAL ENGINEERING MAJOR at the South Dakota School of Mines and Technology. He plans to embark on a career in the chemical manufacturing industry and would like to spend a portion of it working abroad. He is considering whether to pursue a graduate degree in engineering or business administration.

Charles A. Holt, *Nagel Scholar No. 37*

CHARLES IS MAJORING IN CIVIL ENGINEERING at Texas A&M University where he is currently first in his class. He has been active in the ASCE, as well as Engineers Without Borders. He plans to study for a master's in structural engineering and then obtain employment with a reputable engineering company so that he can use his education for the benefit of society.

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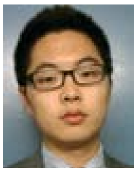
Stabile No. 150	Daniel J. Preston	AL B '12	Mechanical Engineering
Stabile No. 151	Michael J. Schroepfer	SD B '11	Mechanical Engineering
Stabile No. 152	Mary V. Sewall	MS A '11	Industrial & Systems Engineering

Jaimee M. Lofquist, *Nagel Scholar No. 38*
Jaimee is studying biomedical engineering at Michigan Technological University where she has a 4.0 G.P.A. and is chapter President. She plans to continue her education in the medical field to pursue a graduate program for physician assistants. She will also continue as a teaching assistant in the anatomy and physiology lab.

Hannah S. Davis, *Dodson Scholar No. 39*
Hannah is a chemical engineering major at Brigham Young University, serving as chapter President. She plans graduate work and research in chemical biological processes, with an emphasis on biofuels. She is interning this summer with an energy corporation and wants to earn a doctorate to become an energy researcher.

Phillip H. Kang, *Dodson Scholar No. 40*
Phillip is majoring in chemical engineering at the University of Maryland, Baltimore County. He is interested in tissue engineering and plans to pursue an M.D./Ph.D. path. He wants to develop into an innovative physician-scientist who is involved at the interfaces of engineering, life sciences, and medicine.



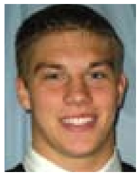
Kellie M. Laws, *Dodson Scholar No. 41*
Kellie is working on a bachelor's degree in chemical engineering at Brigham Young University. She is preparing for graduate school in a biomedical engineering program and then plans to work in this area. She believes that combining the medical field with engineering will allow her to achieve her ambition to serve society.

Alyssa J. Rose, *Dodson Scholar No. 42*
Alyssa is majoring in chemical engineering at the New Mexico Institute of Mining and Technology, where she ranks first in her engineering class with a 4.0 G.P.A. Her passion is to help those living in harsh, Third World conditions, and she plans to do this by creating new methods for water purification.

Danish S. Tarar, *Dodson Scholar No. 43*
Danish is a petroleum engineering major at the University of Kansas, where he ranks first in his engineering class with a 4.0 G.P.A. He has been doing undergraduate honors research and plans to pursue a master's in petroleum engineering. He has been researching topics that include permeability changes.

Elizabeth M. Walker, *Dodson Sch. No. 44*
Elizabeth is a chemical engineering major at Arizona State University, where she has a 4.0 G.P.A. She is currently in a program that allows her to take graduate-level courses. She plans to complete her master's degree. She is leaning toward a career in industry, but may pursue a Ph.D. and a teaching career instead.

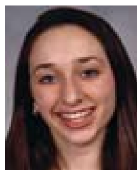
Carl J. Kirpes, *Campbell Scholar No. 24*
Carl is majoring in both industrial engineering and mechanical engineering at Iowa State University, where he ranks first in his class with a 4.0 G.P.A. He will be applying for a Rhodes scholarship. Otherwise, he may continue for a master's degree or work for a couple of years and then study for an M.B.A.



Julie A. Campbell, *Elsa & Peter Soderberg No. 17*
Julie is a biomedical engineering major at Rensselaer Polytechnic Institute, where she is ΤΒΠ Recording Secretary. She plans to earn a master's degree and would then like to work in R&D at a company manufacturing medical devices. She may continue for a Ph.D., but sees her future career in industry rather than academia.

Junhao Chen, *Elsa & Peter Soderberg No. 18*
Junhao is a mechanical engineering major at Binghamton University where he ranks at the top of his class with a 4.0 G.P.A. He is interested in materials research and will be working on solder techniques to enhance the life of electric components. He has decided to continue after graduation for both a master's degree and a doctorate.

Rachel A. Fleming, *GEICO Scholar No. 22*
Rachel is majoring in civil engineering at Duke University and plans to remain for a fifth year to earn her master's. She then will begin a career in either civil engineering or construction management. She enjoyed a construction management internship and is seeking one in design to help her decide on a career path.

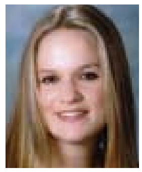


Katherine M. Gardner, *GEICO Schol. No. 23*
Katherine is majoring in industrial and mechanical engineering at the University of Louisville. She is also employed as a co-op student by the Defense Contract Management Agency. This is providing experience as an engineer, an employee, and as a civil servant. She plans to work for the agency after graduation.

Rachna Goyal, *GEICO Scholar No. 24*
Rachna is working on her bachelor's in computer engineering at the University of Cincinnati, where she ranked first in her department. She plans to pursue a master's in electrical engineering. A professor characterized her as "a talented scholar who has natural academic skills ... a soft-spoken yet powerful leader."

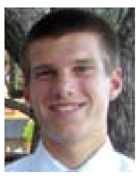
Rachel G. Gutmann, *GEICO Schol. No. 25*
Rachel is majoring in civil engineering at the University of California, Davis, where she ranks at the top of her engineering classwith a 4.0 G.P.A. She plans to work as a structural engineer because she believes that project design in structural engineering is an optimal way to improve the world around her.

Sarah P. Mattessich, *GEICO Schol. No. 26*
Sarah is working on her B.S. in biomedical engineering at the Worcester Polytechnic Institute. She is preparing for a career in biomedical research and plans to obtain both a master's and a Ph.D. to become a principal investigator for a tissue engineering laboratory, as well as serving as a physician.



Trent D. Thomas, *GEICO Scholar No. 27*
Trent is working on a bachelor's in chemical and biomolecular engineering at the University of South Alabama, where he is first in his department. Research interests include heat transfer and focusing on process efficiency. He plans to continue in this area in graduate school to improve efficiency and save non-renewable energy.

J.L. Waltman, *GEICO Scholar No. 28*
Jon is majoring in electrical engineering at the University of California, Santa Barbara, where he is enrolled in a five-year B.S./M.A. program and has a 4.0 G.P.A. He is an active member of the club triathalon team there. He believes that his interests in sports cars and space may lead him to work in either the auto industry or with NASA.



Gloria Y. Condon, *Scribner Scholar No. 15*
Gloria is majoring in chemical engineering at Rensselaer Polytechnic Institute. She has applied for a co-terminal program there that would lead to a master's degree. She is researching photocatalytic devices, transport phenomena, and photochemistry. The terminal goal of her graduate studies is a doctorate.

See additional bios at *www.tbp.org*.

Tau Beta Pi Fellows for 2011-12

THE FELLOWSHIP BOARD SELECTED 35 Tau Beta Pi Fellows for 2011-12, 17 of whom will receive $10,000 cash stipends for one year of graduate study and 18 who have other extensive financial aid for their year of advanced work. Implemented by President A.D. Moore in 1929, the Fellowship Program has provided a total approaching $5,300,000 to 943 stipend recipients.

Now in its 78th year, the Fellowship Program remains a principal philanthropic activity of the Association and continues to receive strong support from alumni. The program was initiated with funds from the operating budget of the Society, including the eventual transfer of fees from deceased life subscribers of THE BENT. It was first enlarged in 1938 by a gift from the Southern California Alumnus Chapter, and in 1948 the first Alumnus Fellowship was awarded. Since that time, gifts from alumni, industry, and friends and the earnings of the invested Fellowship Fund have all contributed to these awards.

Matching gifts to the Association from 225 companies on behalf of their TBΠ employees are allocated to fellowships and scholarships, and the Society is most appreciative of this generous support.

In addition to its own awards, TBΠ selects recipients for named fellowships, which are administered just as other Society fellowships.

The TBΠ–Stark Fellowship is named for Donald A. Stark, who contributed much to progress in the fluid-power industry. This award, given for the 34th time, is presented to a fellow who plans graduate study in engineering with emphasis in the field of fluid power or fluid mechanics. Stipends are provided by the earnings from a $150,000 gift to TBΠ in 1986 from the Donald A. and Jane C. Stark Charitable Trust.

Twenty-three fellowships are named for members. The TBΠ–Williams Fellowship, established to honor the Association's Founder, Dr. Edward H. Williams Jr., is awarded to a candidate who plans to work toward a doctoral degree and enter the engineering teaching profession.

Tau Beta Pi received 217 fellowship applications. Board members Darrell W. Donahue, Susan L.R. Holl, Jammie L.H. Jamieson, and Director of Fellowships D. Stephen Pierre Jr. made the selections on March 26. Fellows are introduced on the following pages.

Two fellowships honor former TBΠ Presidents. The one named for Charles H. Spencer, who served during 1936-47, is awarded for the 56th time. It is presented to the winner who has made significant contributions to his or her collegiate chapter. The Harold M. King Fellowship honors the 1954-58 President, whose special interest was in the student branches of the national technical societies. Given for the 50th time, the King Fellowship is awarded for outstanding participation in volunteer technical-society work.

Fifteen named awards are sponsored by the late William Fife, *CA A '21*, who bequeathed the earnings of an irrevocable trust for TBΠ fellowships. They are named in honor of his father, James Fife.

Walter E. Deuchler Sr. left a bequest in 1979 to endow a fellowship for graduate study in water supply, waste-water treatment, and ecology. The Matthews Fellowship is awarded for the 14th time and honors Secretary-Treasurer Emeritus R.C. "Red" Matthews, *IL A '02*, who served as Secretary during 1905-12 and as Secretary-Treasurer in 1912-47. Red died in 1978 at the age of 99. The 14th Nagel Fellowship is awarded in honor of Secretary-Treasurer Emeritus Robert H. Nagel, P.E., *NY Δ '39*, who served as Secretary-Treasurer in 1947-82 and Editor of THE BENT during 1942-82. Bob died in 1997.

The Hanley Fellowship is named for Mary A. and Edward P. Hanley, *IL B'42*, who left a bequest in 2007. The Lynnworth Fellowships are named for Lawrence C. Lynnworth, *NY E'58*, TBΠ Fellow No. 140, and matched by the GE Foundation.

The Centennial Fellowship, given to that fellow who the board determines is most outstanding, commemorates TBΠ's 100th anniversary.

The TBΠ–Sigma Tau award commemorates Clarel B. Mapes, Sigma Tau's former national president and secretary-treasurer, and perpetuates the memory of Sigma Tau, former national engineering honor society founded at the University of Nebraska in 1904. When it merged with TBΠ in 1974, the assets of its foundation were transferred to the Fellowship Fund.

The TBΠ–Best Fellowship honors Ina C. and Raymond A. Best, *NY Γ'33*, and is for a member to acquire an M.B.A. at Rensselaer Polytechnic Institute. There was no applicant.

FELLOWSHIP	RECIPIENT	CHAPTER	FIELD OF ADVANCED STUDY
Centennial 26	Lauren H. Logan	OH Δ '10	Ecological Sciences & Engineering
Fife No. 139	Eric M. Anderson	AZ B '10	Medicine & Biomedical Engineering
Fife No. 140	Camila Dorin	NY M '11	Computer Engineering
Fife No. 141	Shekhar K. Gadkaree	NY K '10	Medicine
Fife No. 142	Matthew T. Grant	OK Γ '11	Bioscience Enterprise
Fife No. 143	Albert Hsia	AZ B '11	Biomedical Engineering
Fife No. 144	Michael D. Krak, E.I.	OH I '11	Mechanical Engineering
Fife No. 145	Joy L. Marsalla, E.I.	AZ B '11	Environmental Engineering
Fife No. 146	Katrin Passlack	AZ B '11	Bioengineering
Fife No. 147	Nathan G.F. Reaver, E.I.	OH Z '11	Bioengineering
Fife No. 148	Teneil K. Ryno	SD A '11	Materials Science
Fife No. 149	Meredith A. Stella, E.I.	IL B '09	Structural Engineering
Fife No. 150	Raguez Taha, E.I.	IL Z '11	Structural Engineering
Fife No. 151	Abigail R. Wooldridge, E.I.	KY B '11	Industrial Engineering
Fife No. 152	Xuyang Zhang, E.I.	OH B '11	Mechanical Engineering
Spencer No. 56	Jennifer A. Johnson, E.I.	SC A '11	Transportation Engineering
King No. 50	Anahid A. Behrouzi	NC A '11	Structural Engineering
Sigma Tau No. 38	Kelli M. Luginbuhl	CO Δ '11	Biomedical Engineering
Stark No. 34	Andrew J. Komendat	NY Π '11	Mechanical Engineering
Williams No. 32	Pamela E. Jreij	CA AB '11	Bioengineering
Deuchler No. 31	Samantha E. Beardsley, E.I.	NC Γ '09	Environmental Engineering
Matthews No. 14	Alexander Salazar, E.I.	NJ Γ '11	Civil Engineering
Nagel No. 14	Kimberly R. Stillmaker, E.I.	CA P '08	Structural Engineering
Hanley No. 7	Casey M. Davis, E.I.	OK B '10	Mechanical Engineering
Lynnworth No. 3	Timothy M. Douglas, E.I.	CO A '11	Electrical Engineering
Lynnworth No. 4	James D. Follum, E.I.	WY A '10	Electrical Engineering
TBP No. 782	Amanda J. Bares, E.I.	MT A '11	Biomedical Engineering
TBP No. 783	Elizabeth M. Beckett, E.I.	IN A '11	Nuclear Engineering
TBP No. 784	Alisha V. John	MI E '11	Genetics
TBP No. 785	Matthew C. Johnson, E.I.	TX Δ '11	Electrical Engineering
TBP No. 786	Katherine F. Maass	TX A '11	Chemical Engineering
TBP No. 787	Chandra A. Macauley, E.I.	MT A '11	Materials Science & Engineering
TBP No. 788	Ehimwenma Nosakhare	DC A '11	Electrical Engineering
TBP No. 789	Cynthia R. Sung, E.I.	TX Γ '11	Mechanical Engineering
TBP No. 790	Alexander P. VanFosson	IA B '11	Chemical Engineering

Centennial Fellow No. 26

Lauren H. Logan

Lauren received her bachelor's degree in electrical engineering in 2010 from Ohio University, where she was first in her class and served as TBΠ Chapter President and later as Advisor. She also has a B.Sc. in geological sciences. She plans to attend Purdue University and commence graduate studies by working on a master's degree in ecological sciences and engineering. Lauren wants to focus her research on improving energy harvesting materials in order to increase efficiency and decrease pollution as well as costs. This could include nano cantilevers, cleaner solar cells, and biologically based batteries. After completing her doctorate, she will seek a full-time faculty position with the correct balance of teaching and research. She wants to inspire students to inspect the world around them critically while searching for ways to improve technology. It will be her duty to promote green technology to the next generation of engineers, while pursuing her own research in the field.

Fife Fellow No. 140

Camila Dorin

Camila graduated first in her department with a B.S. in computer engineering at Union College. She has applied to Imperial College London for graduate school in computer engineering. A scholarship allowed her to spend her junior year studying at University College London, and internships have included working at the geometric image processing lab at the Technion, Israel Institute of Technology. Her areas of interest are robotics and embedded systems, and she would like to take classes on personal robotics, along with computer-aided design of digital systems. Camila would like to work on research and development in industry and plans eventually to open her own company. She has also been active in organizations including SWE and Engineers Without Borders. She is sure that after she starts graduate studies, a whole new world will open and her ideas could change. So she is confident that further education will allow her to manage future aspirations and objectives.

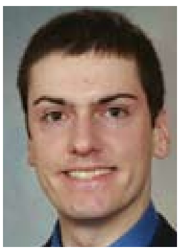
Fife Fellow No. 142

Matthew T. Grant

Matt has graduated from Oklahoma State University with a B.S. in chemical engineering. He has applied to start his graduate studies at the University of Cambridge and has already been granted an opportunity to begin medical school at Baylor College afterward. At Cambridge, he plans to complete a master's in bioscience enterprise, focusing on pharmaceutical and technological discoveries. Matt believes this will equip him with the analytical and entrepreneurial skills needed to bring medical advances to market. During a trip to Honduras, he worked at a government-run hospital assisting with hip and knee replacements. He witnessed a desperate level of medical need and also the connection between for-profit companies and volunteer medical work. He has completed undergraduate minors in economics and Spanish, and the master's in enterprise will be the thread that ties all his interests together. He is passionate about bridging the resources and innovations of groups across national borders.

Fife Fellow No. 139

Eric M. Anderson



Eric received a B.S.E. in bioengineering and a B.S. in biochemistry in 2010 from Arizona State University, with a 4.0 G.P.A. He has developed a passion for biomedical engineering, which resulted from more than a year receiving medical treatment after a baseball injury. He is completing a year of research as a Fulbright scholar at the academic medical center of the University of Amsterdam, and plans to pursue M.D. and Ph.D. training at Stanford University for a career in academic medicine. Experience at the translational genomics research institute has solidified Eric's interest in academic medicine through his research on invasive brain and breast tumors and clinical shadowing experience. He has also found time to be a volunteer clinical tecnician at the Mission of Mercy mobile clinic. Other volunteer service included work at the Hospice of the Southwest and the migrant health education program. Earlier awards included the TBΠ Winkler No. 9 Scholarship and a Barry M. Goldwater scholarship.

Fife Fellow No. 141

Shekhar K. Gadkaree

Shekhar is a biomedical engineering graduate of the University of Rochester, where he finished first in his biomedical engineering class. He plans to study at the Johns Hopkins School of Medicine for an M.D. and believes that the future direction of healthcare rests in the integration of medical knowledge ad clinical engineering. He currently plans to specialize in endocrinology or cardiology, both of which he sees as areas that would greatly benefit from engineering advances. Shekhar's ultimate goal is to elucidate problems in his patients as a specialist and use his engineering background to develop devices to address these concerns. He has been working on a project in Peru aimed at developing a diagnostic device using pressure sensors to identify ulceration risks for patients with diabetic neuropathy. Diabetes is on an upward trend in developing countries, and he plans to focus on a single clinical engineering undertaking that targets global healthcare in a nation like Peru or Uganda.

Fife Fellow No. 143

Albert Hsia

Albert has graduated with a B.S. in biomedical engineering and a 4.0 G.P.A. at Arizona State University, where he served as TBΠ Chapter Treasrer. He has taken the Fundamentals of Engineering exam and has been accepted for ASU's accelerated master's program in biomedical engineering, hoping to obtain this degree in one year. Albert was inspired to pursue this study by his interest in how technology can serve the greater good by creating innovative healthcare solutions while reducing medical costs. During his undergraduate study, he was involved in creating an electrocardiogram that can be interfaced to any computer for less than 10 percent of the average cost of a commercial device. This showed him the enormous potential for engineering to address rising healthcare costs, and he plans to focus on courses that will help him prepare for a career in the medical-device industry. It is possible that he will establish his own company in the next few years.

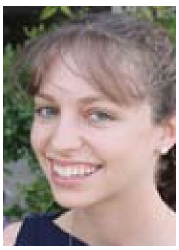
Fife Fellow No. 144

Michael D. Krak, E.I.

Michael has graduated with a bachelor's in mechanical engineering from Ohio Northern University, where he served as ΤΒΠ Chapter Corresponding Secretary. He plans to pursue a master's at Ohio State University and has passed the Fundamentals of Engineering exam. His objective is to earn a doctorate in mechanical engineering, specializing in vibrations, acoustics, and mechanics. Graduate research will focus on vibration monitoring systems, turbomachinery, engines, and automotive suspensions. This follows his co-op experience, in which he was responsible for maintaining pumps, compressors, and turbines at an oil refinery. Vibration analysis allows failing machinery to be taken off-line before catastrophic failure occurs and is a diagnostic tool for repair personnel. It is Michael's ultimate goal to teach at an undergraduate engineering college. His acoustic vibration experience at Ohio Northern included playing the saxophone in the university's orchestras and the marching band.

Fife Fellow No. 145

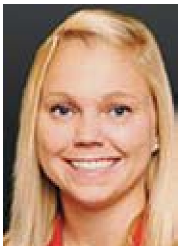
Joy L. Marsalla, E.I.



Joy is an environmental engineering master's graduate of Arizona State University, where she ranked first in her department with a 4.0 G.P.A. She has already passed the Fundamentals of Engineering exam and believes it is important for her to obtain her certificate in project management eventually. Joy plans to remain at her *alma mater* for environmental engineering graduate studies, focusing on water system management, environmental chemistry, and water regulations. She planss to work for a governmental agency ultimately so that she can concentrate on water quality and regulation This will most effectively enable her to influence the management of what she believes to be our most important resource. She is also active in SWE and believes in the importance of ethics in engineering. She plans to work with the school administration on an Order of the Engineer ceremony in which seniors, alumni, and professors take an ethical oath, similar to the Hippocratic oath for doctors.

Fife Fellow No. 146

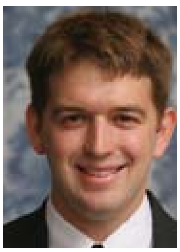
Katrin Passlack



Kat graduated from the University of Oklahoma, where she was first in her class with a G.P.A. of 4.0, receiving a B.S. in mechanical engineering. She plans to start postgraduate studies in bioengineering at the University of Washington and plans to pursue an academic career. Her specific research focus will be cancer detection and treatment technology development, at the intersection of molecular biology, genetics, and nanotechnology. This follows a summer that she spent as an NSF intern at Johns Hopkins. Kat believes that by fostering collaboration among engineers, scientists, and doctors to probe the boundaries of technology, engineering in oncology will be a contributing factor toward accelerating the downward trend in cancer death rates and improving patient quality of life. She has also been active in collegiate rowing as both a competitive team member and as a coach, as well as being a gymnast. She plans to take the Fundamentals of Engineering exam when rowing commitments allow.

Fife Fellow No. 147

Nathan G.F. Reaver, E.I.



Nathan has received his B.S. with a dual major in bioengineering and physics from the University of Toledo. He is remaining on campus to start graduate studies in bioengineering and has passed the Fundamentals of Engineering exam. He wants to undertake research and take many advanced education courses along the path to an engineering doctorate. He plans to research biomedical optics or biomass conversion into useful products and genetic engineering of microbes. Nathan is interested in ways of making more efficient conversion of cellulose into sugars, and hence better ethanol conversion. He has developed an interest in alternative energy and sustainability. He has also undertaken extensive work on photovoltaics, believing that new energy sources will be vital to our society in the near future, and wants to bring them into the commercial realm. His ultimate goal is to use the fruits of his studies to start a company specializing in making renewable energy available to the average individual.

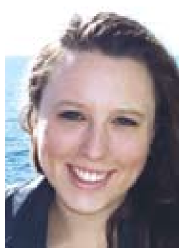
Fife Fellow No. 148

Teneil K. Ryno

Teneil has completed a bachelor's in metallurgical engineering at the South Dakota School of Mines & Technology, where she ranked first in her department. She will remain in Rapid City and start postgraduate studies in materials science. She plans to earn a P.E. license to work as a failure-analysis consultant and will be taking the Fundamentals of Engineering exam because of her interest in forensic engineering. Teneil has studied the reliability of tin-alloy solders that are widely used in industry. The transition from lead to tin alloy has impacted major companies like Toyota and Swatch Watches, and they have carried out substantial product recalls due to electronic failures. This also has aerospace applications in department of defense projects, in which she has some experience. She believes that prolonged studies on the life expectancy of lead-free solders will provide data to help create manufacturing guidelines. Other activities has included involvement in SWE and Engineers Without Borders.

Fife Fellow No. 149

Meredith A. Stella, E.I.



Meredith graduated at the top of her class with a B.S. in civil engineering and a G.P.A. of 4.0 at the Illinois Institute of Technology. She has already passed the Fundamentals of Engineering exam. Her next move is graduate studies in structural engineering at the University of Maryland, College Park. Meredith comes from a family of baseball fans. She was inspired by engineering when a childhood friend's engineer father helped build a new home for their beloved Seattle Mariners, and she was awed by downtown skyscrapers. She hopes that a graduate degree will help her become a professional structural engineer and one day help to design structures like the ones that inspired her as a child. Coming from the earthquake-prone West Coast, she is also extremely interested in seismic design for large structures. She would like to study more efficient damping methods and ways to control the destructive vibrations caused by seismic events. Other activities have included the ASCE and Alpha Sigma Alpha.

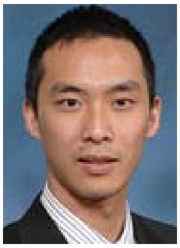
Fife Fellow No. 150

Raguez Taha, E.I.

Raguez has received her B.S. in civil engineering from the University of Illinois at Chicago. She plans to commence graduate studies in structural engineering at her *alma mater* after a semester at Illinois Institute of Technology and has passed the F.E. exam. After receiving her master's, she would like to work in industry for a few years to develop her professional skills. She would delay a doctorate at this stage because she learned the most as an undergraduate from professors with industrial experience who could connect theory to real practice. Since she and her family left Iraq 13 years ago, she always planned to return some day. Raguez would like to use her knowledge to help rebuild Iraq's infrastructure, with a focus on public facilities like schools and hospitals. She was appalled by the neglected state of such facilities when she last visited there. After working in Iraq, she plans to pursue a Ph.D. in structural engineering. She has also been active in ASCE, SWE, and Engineers Without Borders.

Fife Fellow No. 152

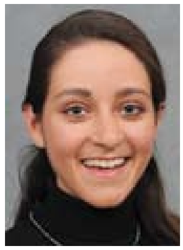
Xuyang Zhang, E.I.



Xuyang graduated at the top of his class at the University of Cincinnati with a B.S. in mechanical engineering and a G.P.A. of 4.0. He plans to pursue a master's at Stanford University and has passed the F.E. exam. TBΠ Stabile Scholar No. 129, he intends to obtain a Ph.D. and eventually become a technical leader in industry or research. Xuyang attended UC through its joint degree program with Shanghai Jiao Tong University, and believes engineering professionals will be a valuable resource for development in China. He has already undertaken research in areas such as finite-element analysis and computational fluid dynamics. His primary research interests are in renewable energy technology because of the world's energy situation. He wants to learn how to contribute his experience in control, modeling, and simulation to solving this. He is also interested in biomechanics and robotics and has been looking at robotic prosthetics for people who have lost limbs.

King Fellow No. 50

Anahid A. Behrouzi



Anahid graduated first in her class with a 4.0 G.P.A. gaining a B.S. in civil engineering from North Carolina State University. She will enter the University of Illinois at Urbana-Champaign for graduate work in structural engineering and is taking the F.E. exam. Anahid has been a research assistant at her school's center for nuclear-power-plant structures, equipment, and piping and working on evaluation of seismic behavior. She has long been interested in the impact of earthquakes on buildings and believes there is a global need to investigate construction methods. She plans to go on for a doctorate relating to earthquake performance of structures and join an international engineering firm to design or retrofit buildings to make them safer. She hopes one day to join faculty at an institution striving for interdisciplinary research on structural design, particularly for earthquake-prone regions. She has also been active in SWE and ASCE and served as a volunteer Spanish translator.

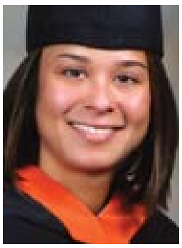
Fife Fellow No. 151

Abigail R. Wooldridge, E.I.

Abigail graduated at the top of her class at the University of Louisville with a B.S. in industrial engineering and a G.P.A. of 4.0. She is remaining on campus to pursue her master's and has passed the Fundamentals of Engineering examination. During a co-op assignment, she worked in the healthcare-solutions department at a consulting company. Abigail saw the application of efficient engineering practices at hospitals and believes that there are many areas of industrial engineering that would benefit the healthcare system. She is also interested in the application of industrial engineering to the evacuation of hospitals, which traditionally have been viewed as only service providers in an emergency situation. Recent events like Hurricane Katrina have shown the importance of topics like evacuation planning. Her ambition is to teach eventually at a nationally-recognized research institution. She plans to follow her master's degree with studies for a doctorate in order to achieve her goals.

Spencer Fellow No. 56

Jennifer A. Johnson, E.I.



Jennifer received her B.S. in civil/transportation engineering from Clemson University, where she served as TBΠ Chapter President and graduated first in her class with a 4.0 G.P.A. She was also SWE president. She is staying on campus for her master's in transportation and has already passed the F.E. exam. Her research has involved integrating electric vehicles into an emerging concept in which vehicles and infrastructure communicate with one another in real-time to improve efficiency, mobility, and safety. Jennifer's project encompasses the necessity of communication and computer tools so that vehicles, infrastructure, and electric grid/charging resources can work together in sustainable communities. She will focus on real-world situations where electric vehicles can be supported, while considering mobility, economic, environmental, and public-policy issues. She will have opportunities to collaborate and intern with professionals at Ford Motor Company and Argonne National Laboratory.

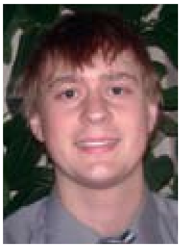
Sigma Tau Fellow No. 38

Kelli M. Luginbuhl

Kelli graduated first in her class scholastically at Colorado State University. with a B.S. in chemical and biological engineering She plans to begin graduate studies in biomedical engineering at Duke University and believes that graduate school will enable her to realize her full potential as an engineer. Kelli's summer internships and community service have been the most important factors in her aspirations. The first, at the National Institutes of Health, taught her research discipline and led to her presenting her summer's work at a conference. The second was at Cornell University, where she worked with cutting-edge technology in nanotechnology and biomaterials. She has mentored Native American women to pursue science and higher education and helped middle-school girls become interested in math and science. She plans to pursue a doctorate in biomedical engineering, focusing on ways to improve medicine, surgery, and the quality of life, extending the possibilities of medicine through human design.

Stark Fellow No. 34

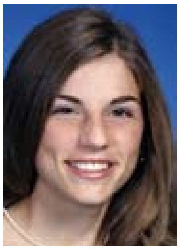
Andrew J. Komendat



Andrew is a mechanical engineering graduate of the Rochester Institute of Technology, where he had a 4.0 G.P.A. and was ΤΒΠ Chapter President. He is remaining on campus for graduate work in mechanical engineering and plans to take the F.E. exam. He will begin work on a project to create a cheap device to track the orientation and position of objects. This would be miniaturized for micro air vehicles, specifically for environments where GPS capabilities are unavailable, including jammed territories, cave networking and mapping, and underwater applications. During the summer, he began his second co-op assignment at NASA Glenn Research Center and will be attending the AIAA conference on guidance, navigation, and control. Andrew is considering later study for a doctorate, but does plan to enter industry after completing his master's. He hopes to work on aircraft control applications, possibly designing control systems for autopilot systems and unmanned air vehicles.

Deuchler Fellow No. 31

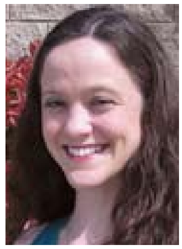
Samantha E. Beardsley, E.I.



Samantha is a 2009 B.S.E. graduate of Duke University. Having passed the Fundamentals of Engineering exam in 2008, she will attend graduate school at the University of California, Berkeley. Her ambition is to pursue a Ph.D. in environmental engineering and become an expert in water quality engineering, working to improve resources in the U.S. and internationally. She sees the worldwide degradation of water quality and quantity as increasingly prominent issues and as a negative impact of climate change. Samantha plans to pursue high-level research on a specific and critical water quality issue to improve her knowledge and make a contribution. While in graduate school, she also plans to mentor undergraduates, as well as middle- and high-school students interested in engineering. She believes in promoting this field, especially to young women, and hopes to continue mentoring throughout her career. She has also taken part in the Boston, Disney World, and Sydney marathons.

Nagel Fellow No. 14

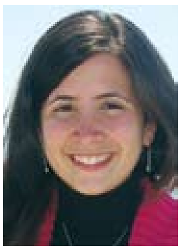
Kimberly R. Stillmaker, E.I.



ΤΒΠ Nagel Scholar No. 26, Kimberly will enter the master's degree program in structural engineering at the University of California, Davis, with the goal of becoming a college professor. She currently serves as a District 15 Director, the most recent of a series of positions in ΤΒΠ. Kimberly is currently teaching a course on professional topics in mechanical engineering at California State University, Sacramento, and also works in her family's property-management business. She graduated first in her class with a G.P.A. of 4.0. at California State University, Fresno, in 2008. She stayed there and received an M.B.A. in 2010. Although she enjoyed the time spent working at a structural design firm, she prefers the social interaction, challenge, variety, and level of autonomy of being a professor. Research will be in either structural health monitoring or earthquake engineering. She believes that either of these will expose her to the engineering process and prepare her to advise students as a professor.

Williams Fellow No. 32

Pamela E. Jreij



Pamela graduated first in her class at the University of California, Riverside with a 4.0 G.P.A. and a B.S. in bioengineering. She was ΤΒΠ Chapter Vice President. Graduate school plans include moving to UC, Berkeley, to pursue a Ph.D. in bioengineering with an emphasis on biomechanics. Research in this field has highlighted the critical role of the mechanical properties of biological systems. Her independent research has included developing a method to characterize electrostatic properties of cell layers and involved designing a device, establishing an experimental protocol, and developing a mathematical model to measure across cell layers. Pamela also developed models that capture the human brain's biomechanical response to traumatic brain injuries. Her goals have been focused on establishing a research career path in biomechanics, while contributing to overall knowledge within that field. Later, she plans to pursue a research career as an engineering professor and researcher in academia.

Matthews Fellow No. 14

Alexander Salazar, E.I.

Alexander majored in civil engineering at the New Jersey Institute of Technology. He is going to Princeton University to study for a master's in civil engineering, and he has passed the Fundamentals of Engineering examination. He will be specializing in structures and will study design as related to earthquakes and composite materials, and he would like to be able to determine building applications using alternative composite materials. While interning with a large construction and aggregate-materials-supply company, Alexander has furthered his understanding of the behavior of components in composites. His goal is to obtain a position with a large structural design firm, working on innovative and exciting projects all over the world. He would also like to start his own engineering consulting firm, providing solutions for the aging infrastructure of the U.S., and working to ensure safe, efficient structures. He has also been active in the ASCE and Engineers Without Borders.

Hanley Fellow No. 7

Casey M. Davis, E.I.

Casey graduated first in his mechanical engineering department at the University of Tulsa with a 4.0 G.P.A. Graduate school plans include relocation to Stanford University, and he has passed the Fundamentals of Engineering exam. He served as 2009-10 ΤΒΠ Chapter President. He has spent the last two years working on a new theory of fatigue-crack growth in ductile metals, which would reduce the amount of testing necessary in material selection by using the finite-element method for a single computational effort. This project has solidified Casey's decision to pursue research professionally. He has been praised for assisting and tutoring other students, as well as serving his community by volunteering at churches and helping with a summer engineering academy for high-school students. He has been an undergraduate researcher with NASA and interned as a design engineer. He also presented a paper at the International Conference on Multiaxial Fatigue and Fracture in Parma, Italy.

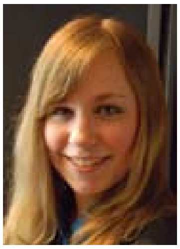
Lynnworth Fellow No. 3

Timothy M. Douglas, E.I.

Tim has received a bachelor's in electrical engineering at the Colorado School of Mines, where he served as TBΠ Chapter President. He was named to the dean's list every semester and plans his graduate studies at his *alma mater*. He has served two summer internships with Lockheed Martin's missiles and fire-control group and plans to do a third. This involved assisting with hardware and guidance software integration of a new version of the *Patriot* missile system and evaluating the effects of radio-frequency radiation on discrete circuit components in enemy aircraft. Tim plans to apply for full-time employment with the firm after completing his master's. He plans to dedicate his career to the improvement of existing technologies and the creation of new, innovative ones for the nation's state-of-the-art defense systems. His specializations will increase his professional value and make significant contributions to advanced defense technologies. He has also been an active in the IEEE.

Tau Beta Pi Fellow No. 782

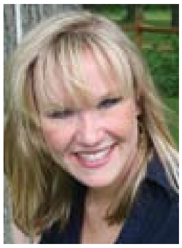
Amanda J. Bares, E.I.



Amanda is an electrical engineering graduate of Montana State University, where she was first in her E.C.E. department. She plans to begin graduate school this fall at Cornell University, where she will take courses on the basic concepts of biomedical engineering, and she has passed the F.E. exam. Her plans are to pursue a Ph.D., and she wishes to perform research in industry or academia. Amanda would like to design imaging systems or techniques to understand further how the human body operates and how to fix problems that occur when one of the millions of bodily processes malfunctions. She believes that her undergraduate research on laser systems for atmospheric imaging has provided the skills she needs to succed in independent research. Her interest lies in noninvasive imaging techniques that are key technologies in areas like cancer diagnostics. Extracurricular activities include playing trombone for her university's orchestra and for the Intermountain Opera Association.

Tau Beta Pi Fellow No. 784

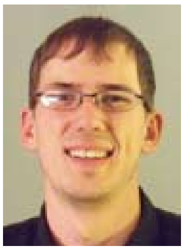
Alisha V. John



Alisha graduated first in her department with a B.S. in chemical engineering at Wayne State University, where she served as TBΠ Chapter President. She plans to enter a Ph.D. program in genetics at the University of Michigan and believes that her engineering background will continue to serve as a driving force and that this mindset will be unique to her Ph.D. program peers. Alisha plans to focus on human genetic diseases, determining causes, working on treatments, or improving testing and screening procedures. After completing graduate studies, she plans to obtain experience for further training and then seek a tenure track-position as a university professor. Once established in genetics and at a university, she will pursue positions like departmental chair or dean to hone her leadership skills. She has additional research experience as an engineering technician and aide at the U.S. Army's tank automotive research, development, and engineering center, conducting tests and analyzing data.

Lynnworth Fellow No. 4

James D. Follum, E.I.



TBΠ Stabile Scholar No. 107, Jim is an electrical engineering graduate of the University of Wyoming, where he served as TBΠ Chapter Recording Secretary. He is on the B.S./M.S. program there, which allows students with strong academic backgrounds to enroll in the master's program during their junior year. He is remaining on campus to continue his graduate education in electrical engineering. Jim has been researching in signal analysis and power systems. He spent a summer internship at the Department of Energy's Pacific Northwest National Laboratory, working with an electrical energy group that is deeply involved in *smart-grid* applications. He spent a summer working at a Cheyenne, WY, utility and developed databases to help large customers manage their electricity use. He has also been involved with an NSF program on topics related to the reliability of the Western U.S. power grid. These experiences have influenced his plans for further graduate study.

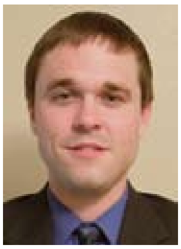
Tau Beta Pi Fellow No. 783

Elizabeth M. Beckett, E.I.

Liz graduated with a B.S. in nuclear engineering at Purdue University. She has passed the F.E. exam and will begin her graduate work at the University of Michigan. She has always been fascinated by the subject of energy and believes that the problem of sustainable energy is one of the biggest challenges facing civilization. She further believes that nuclear power will play a major role. Liz has spent the last two summers working on spent-fuel management and disposal, the last one on a project at Lawrence Livermore National Laboratory involving spent fuel from a fusion-fission hybrid system. Her proposed research in graduate school will be to investigate interactions of actinides in borosilicate-glass matrix. Her long-term ambition is to serve as a professor of nuclear engineering and to continue research in nuclear materials or radioactive waste management. She loves to tutor and teach and wants to help produce the next generation in her field. She has also been active in the Society of Women Engineers.

Tau Beta Pi Fellow No. 785

Matthew C. Johnson, E.I.



Matthew graduated with a B.S. in electrical engineering at Texas A&M University at the top of his class and with a 4.0 G.P.A. He plans to stay there for graduate studies in power electronics and has passed the Fundamentals of Engineering examination. Matthew will divide his time between academic work and research with an emphasis on power-converter topologies, electric-motor drives, and digital-signal processing. He will draw heavily on his summers of internship experience at Raytheon and L-3 Communications, where he observed power considerations in the design process for a variety of products. After earning his master's, and possibly a doctorate, he plans to work in industry on either electric vehicles or power systems for applications like aircraft and unmanned vehicles. His long-term goal is to teach at university level and help to develop the next generation of America's engineers. Activities outside class and lab included being an intramural basketball team captain.

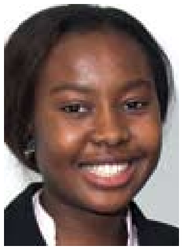
Tau Beta Pi Fellow No. 786

Katherine F. Maass

TBΠ–GEICO Scholar No. 21, Katie received a bachelor's in chemical engineering from the University of Texas at Austin. She will begin graduate work at the Massachusetts Institute of Technology, where she interned, and will take the F.E. exam. She plans to help develop and refine a novel drug-delivery system to improve cancer treatment. It would target the drugs specifically at cancer cells and avoid toxic effects to organs throughout the body. This follows the early loss of her grandmother to breast cancer, and she wants to see that no cancer patient must suffer the unnecessary side effects of chemotherapy. Katie plans to earn a doctorate and pursue a research career for five years in the pharmaceutical or biotechnology industry. She has already interned at drug company Merck. She would like to work as a professor and believes that her experience in industry will provide a different perspective and help her to show students how their studies apply to the *real world*.

Tau Beta Pi Fellow No. 788

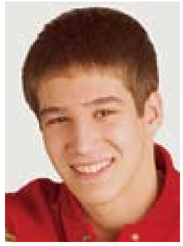
Ehimwenma Nosakhare



Ehi is an electrical engineering graduate of Howard University, where she ranked first in her class with a 4.0 G.P.A. and served as TBΠ Chapter President. TBΠ Record Scholar No. 567, She plans to attend the Massachusetts Institute of Technology for graduate studies in E.E. and has already taken part in a summer research program there. Ehi plans to become a research professor of the first rank in analog-circuit design. Growing up in the developing country Nigeria showed her the positive impact that readily available and efficient electronic systems can have on such nations. She believes that with a Ph.D. and more experience she will be equipped to take part in research that will have a global impact. Particular interest lies in RF mixed signal circuit design, along with design for applications in biomedical electronics and medical implants. Experience in the laboratory and during an industrial internship have given her an urge to discover, invent, and discover the unknown.

Tau Beta Pi Fellow No. 790

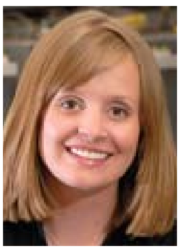
Alexander P. VanFosson



Alex has completed a bachelor's in chemical engineering at the University of Iowa, at the top of his class with a G.P.A. of 4.0. He plans to begin graduate studies at the University of Colorado at Boulder. After traveling in Ghana and Mexico, he is eager to help people in the developing world. Alex does not want the world to remain as it is—he wants to make it better. TBΠ Stanley Scholar No. 1, he is a member of Engineers Without Borders. Undergraduate studies taught him the basics of researching and problem-solving, and he designed a hand-held chlorination device to make water potable. When funding for the project ended, the design was cheap, durable, and could produce significant amounts of bleach disinfectant. He wants to continue studying chemical engineering and eventually become a professor, not just because of his interest in the subject, but also because it is the discipline most suited to solving the problems of water quality in the developing world.

Tau Beta Pi Fellow No. 787

Chandra A. Macauley, E.I.



Chandra has received her B.S. in chemical engineering from Montana State University, where she ranked first in her department. Graduate school plans involve work toward a Ph.D. in materials engineering at the University of California, Berkeley. TBΠ Record Scholar No. 564, she is focusing on the materials science advances needed to overcome society's energy challenges. Given the importance of materials in energy-conversion systems, she plans to contribute to the field of high-temperature coatings. After receiving her doctorate, Chandra intends to continue pursuing a career in research, education, and outreach while working at a national laboratory or in academia. She has already done research at a university in Sweden and plans a future internship at a national laboratory. Her belief in the importance of educating youth means that she plans to work in outreach programs. She would also like to initiate new ventures like the "shadow an engineering major" program that she coordinated at her university.

Tau Beta Pi Fellow No. 789

Cynthia R. Sung, E.I.

Cindy graduated first in her department with a B.S. in mechanical engineering from Rice University. She plans to start graduate studies at the Massachusetts Institute of Technology and has passed the F.E. exam. She decided to enter the field of bio-inspired robotics research after her sophomore year when she interned at the NASA Robotics Academy. They discussed bio-inspired locomotion alternatives to the currently more common, but less versatile, strategies like wheels. She heard about work on dragonfly-inspired flight, crawling and gliding robots, and even designs based on amoebas. So Cindy plans to work on these ideas at graduate school and then at a research institution. She has supplemented her education with skills in programming, circuit design, signal processing, and algorithm design, in addition to a solid foundation in mechanical engineering. She plans to remain an active member of the Society of Women Engineers and to provide a good role model for any female aspiring to a STEM field.

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- Gifts of cash, stock, real estate, and life insurance,
- Charitable gift annuities, and
- Charitable remainder trusts.

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CHAPTER ETERNAL

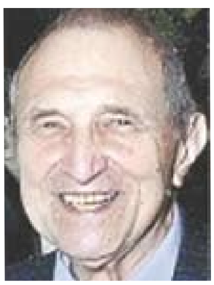
The condensed style of these notices of death is made necessary by Tau Beta Pi's large membership and space limitations in THE BENT. *You may write the Editor for further facts concerning the following deceased members. The assistance of all is earnestly sought in reporting to TBΠ the deaths of Association members, with appropriate details.*

AL B '43 **Smith, William F.;** December 1, 2010.
'47 **Harris, Robert C.;** June 23, 2008.
'60 **Couch, Kenneth R.;** October 25, 2010.
'06 **Devin, Nickless M.;** October 30, 2010.
AL E '60 **Raburn, Wilford D.;** July 9, 2005.
AZ A '49 **Wymore, A. Wayne;** February 24, 2011.
'50 **Henderson, William C.;** no details.
AR A '39 **Engstrom, Harold J.;** February 5, 2002.
'50 **Taylor, James E.;** December 9, 2010.
CA A '41 **Jakel, Otto W.;** February 5, 2006.
'50 **Usim, William;** no details.
'59 **Kojima, Moonray;** August 12, 2010.
CA B '44 **Knopoff, Leon;** January 20, 2011.
CA Γ '48 **Schieber, Norman B.;** November 3, 2006.
'48 **Shuler, John W.;** September 24, 2008.
'49 **Adams, Ernest W.;** March 29, 2009.
'49 **Cairns, William C.;** March 28, 2000.
'49 **Isenberg, Ernest;** August 12, 2005.
'49 **McKenzie, Dee W.;** May 3, 2010.
'49 **Menzel, John;** June 1, 2006.
'49 **Muffley, Robert V.;** November 20, 1998.
'49 **Nichols, Charles L.;** June 2, 1999.
'49 **Payne Jr., Frank A.;** August 18, 2000.
'49 **Pennington, Luis P.;** November 30, 1996.
'49 **Phillips, Patrick J.;** August 30, 2008.
'50 **Brannian, William R.;** September 24, 2002.
'50 **Buchholz, Floyd C.;** August 14, 1989.
'50 **Donald, James C.;** April 11, 2004.
'50 **Downey, Wilbur F.;** November 26, 2008.
'50 **Duerden, Raoul S.;** March 11, 2008.
'50 **Harley, James M.;** no details.
'50 **Hudson, Claude A.;** December 20, 2009.
'50 **Knudson, Jack A.;** November 28, 1989.
'50 **Mayer, Edward H.;** January 19, 2010.
'50 **Thompson, James E.;** November 11, 1992.
'51 **Hill Jr., Francis J.;** March 2, 2005.
'51 **Horwitz, Leonard H.;** February 10, 2001.
'51 **Sheppard, James C.;** July 3, 1998.
'51 **Stansch, Herschel C.;** April 25, 2000.
'52 **Abou-Taleb, Naim M.;** February 2, 1993.
'52 **Barton Jr., David B.;** November 21, 1997.
'52 **Bates, Lawrence P.;** September 12, 2009.
'52 **Gallagher, Philip B.;** no details.
'52 **Gazis, Denos C.;** August 8, 2004.
'53 **Brown, Norman L.;** March 4, 2010.
'53 **Conrad, David A.;** November 12, 2007.
'53 **Evers, David K.;** July 6, 2008.
'53 **Geering, George T.;** no details.
'53 **Hannaford, Jack F.;** April 29, 2010.
'53 **Hughes, John R.;** April 13, 2008.
'53 **Inouye, Mamoru;** November 14, 2004.
'53 **Kooken, John F.;** May 1, 2007.
'53 **La Bree, Charles T.;** June 14, 2004.
'53 **Lichti, Robert D.;** April 20, 2006.
'53 **Mosher, Leland O.;** November 17, 2008.
'53 **Norem, Allan G.;** July 25, 2003.
'53 **Rempel, Robert C.;** May 27, 2005.
'53 **Thompson, Willis;** October 27, 2005.
'55 **Cullinane, James F.;** September 13, 2009.
'55 **Schwarz, Karl E.;** February 19, 1997.
'55 **Wilcox, Robert E.;** no details.
'56 **Danninger, Gregory A.;** February 11, 2002.
'56 **Nichols, Donald K.;** January 6, 1998.
'57 **Crawford, Leon P.;** September 24, 2004.
'57 **Gruver, Arthur B.;** August 29, 2010.
'58 **Briggs, Donald C.;** August 12, 2010.
'58 **Laden, Glenn M.;** June 27, 2001.
'58 **Lee, Richard T.;** December 25, 2005.
'58 **Lindsay, Robert E.;** September 18, 2003.
'58 **Robertson, Baldwin;** April 21, 2008.
'58 **Scott, David G.;** April 3, 2005.
'58 **Skovholt, John;** January 19, 2008.
'58 **Tigner, Robert E.;** no details.
'58 **Twite Jr., Martin J.;** August 10, 1997.
'59 **Green, Kenneth A.;** May 16, 2008.
'59 **Milstead, Frank C.;** July 2, 2005.
'59 **Shaver, William M.;** no details.
'59 **Todd, Ronald H.;** February 9, 2004.
'60 **Krembs, George M.;** March 26, 2009.
'60 **Reynolds, Richard A.;** March 16, 2002.
'61 **Park, Chung G.;** December 28, 2003.
'62 **Leavenworth, Richard S.;** October 18, 2007.
'62 **Morse, Howard L.;** July 6, 2005.
'62 **Peoples, Philip R.;** December 21, 2007.
'63 **Beaman, Kenneth G.;** January 4, 1998.
'63 **Lionberger, Steve R.;** April 1, 1997.
'63 **Norris Jr., Carroll B.;** October 29, 2006.
'64 **Snively, Robert N.;** January 17, 2009.
'67 **Larson, George D.;** February 3, 2000.
'67 **Paulson Jr., Boyd C.;** December 1, 2005.
'68 **Kropp, Dean H.;** April 11, 2003.
'74 **Marshall, Larry J.;** April 29, 2010.
CA Δ '49 **Nelson, Thomas A.;** no details.
CA E '54 **Brittain, James K.;** August 13, 2007.
'60 **Birindello, Luciano;** October 29, 2008.
CA Z '61 **Torrano, Michael A.;** September 20, 2009.
CO A '39 **Golden, John P.;** March 12, 2011.
CO B '34 **Wilson, Benjamin A.;** no details.
'42 **Allen Jr., John T.;** June 6, 2010.
'48 **Timmerhaus, Klaus D.;** February 11, 2011.
'49 **Mitsch, Lawrence J.;** October 29, 2009.
'54 **Riley, Russell B.;** December 6, 2010.
CT A '40 **Sweet Jr., Joseph C.;** April 6, 2011.
'43 **Hummel, Charles E.;** August 16, 2004.
DC Γ '52 **Freeman, James T.;** April 26, 2009.
FL A '49 **Cameron Jr., William W.;** February 25, 2011.
'65 **Lee Jr., Randolph E.;** February 15, 2009.
FL B '48 **King Jr., Walter B.;** January 29, 2010
GA A '32 **Whitfield, Randolph;** August 1, 2009. *[Centenarian 72]*
'48 **Diana, Leonard M.;** January 23, 2011.
'48 **Groce, John C.;** February 28, 2011.
'52 **Freeman, John W.;** March 10, 2010.
ID A '39 **Satre, Wendell J.;** November 19, 2010.
IL A '36 **Miller, Wendell E.;** January 8, 2011.
'43 **Kohnert Jr., Arnold F.;** no details.
'46 **Breinin, Lawrence J.;** April 17, 2009.
IL Γ '41 **Samsel, Richard W.;** February 16, 2011.
'48 **Anderson, George W.;** February 17, 2011.
IL B '35 **Searl, Edwin N.;** April 15, 2011.
IL Δ '63 **Markley, Donald L.;** October 22, 2009.
IN A '48 **Shull, Eugene R.;** November 12, 2006.
'50 **Clarke, Joseph H.;** November 5, 2009.

'50 **Wooten, James M.;** February 5, 2006.
'51 **Morris, James G.;** 2006.
'53 **Spitler, Everett E.;** March 16, 2009.
'55 **Siefert, Robert G.;** May 30, 2008.
'68 **Flick, Parke K.;** March 7, 2011.
IN Β '47 **Wolf, Robert W.;** September 20, 2010.
'76 **Ruppel, John S.;** no details.
IN Γ '42 **Saxe, Harry C.;** September 4, 2010.
IN Δ '63 **Moellenhoff, Ralph E.;** January 31, 2011.
IA Α '39 **Prudhon, Clark H.;** January 10, 2011.
'41 **Wunn, Merlin O.;** January 14, 2010.
'45 **Kokjer, Carter H.;** December 4, 2010.
'54 **Wood, David T.;** December 14, 2008.
IA Β '42 **Arganbright, Donald J.;** February 10, 2011.
'49 **Coobs, Melvin E.;** no details.
'65 **Young, Richard N.;** February 15, 2006.
KS Α '45 **Miller, Robert A.;** January 28, 2007.
'57 **Franklin, Marjorie A.;** February 1, 2011.
KY Α '47 **Maupin, Joseph T.;** no details.
'77 **Morris, James R.;** July 13, 2010.
LA Α '62 **Mangham, Michael R.;** September 16, 2010.
LA Γ '84 **Bearden, Clifford M.;** November 18, 2009.
ME Α '41 **McKay, Gordon B.;** February 14, 2011.
'44 **Sleight, Earland K.;** January 7, 2011.
'55 **Standley, Peter G.;** January 8, 2011.
MD Α '43 **Boenning, Charles B.;** February 25, 2011.
'48 **Gore Jr., John W.;** February 19, 2011.
'54 **Seyboth, Donald C.;** July 27, 2010.
'58 **Pontius, Norman A.;** November 17, 2002.
MD Β '49 **Hoffman, Charles W.;** July 8, 2010.
'50 **Deavers Jr., Clyde J.;** July 20, 2003.
MA Α '40 **Forkey, Raymond J.;** February 23, 2011.
MA Β '41 **Nelson, Conrad N.;** January 1, 2009.
'42 **McClintock, Frank A.;** February 20, 2011.
'49 **Moore, David C.;** November 11, 2010.
'51 **Gibson, Paul B.;** November 14, 2010.
MA Γ '33 **Saparoff, Michael;** January 19, 2011.
MA Ε '47 **Aho, Raymond E.;** November 30, 2009.
'58 **Smith Jr., William H.;** February 22, 2011.
MA Ζ '58 **Nersesian, Gilbert K.;** January 29, 2011.
MI Α '41 **Weaver, Edgar L.;** no details.
MI Β '49 **Bernholdt Jr., Arthur G.;** July 2, 2010.
'52 **Sundstrom, Raul D.;** April 2, 2010.
MI Γ '36 **Davey, James R.;** March 21, 2007.
'37 **Collatz, Gustav T.;** February 16, 2008.
'40 **Britton, E. Robert;** no details.
'43 **Reynolds, Thaine W.;** September 24, 2008.
'50 **Sundstrand, Warren D.;** August 1, 2006.
'55 **Pangborn, John C.;** January 30, 2008.
'63 **Duiven, Richard P.;** no details.
'63 **Liang, Alexander C.;** May 2, 2009.
'63 **Randall, David L.;** December 16, 2010.
MI Ε '38 **Wingerter, Robert G.;** January 3, 2011.
'49 **Frank, Max;** March 29, 2010.
'50 **Bostwick, William L.;** no details.
MI Ζ '40 **Anderson, Harley J.;** August 28, 2008.
MN Α '44 **McKenzie, Roy R.;** January 7, 2011.
'52 **Jensvold, Robert D.;** March 10, 2011.
MS Α '44 **Wier, David D.;** December 6, 1993.
'48 **Brandon, Clifford N.;** October 19, 2010.
MO Α '42 **Rand, Russell W.;** February 5, 2011.
'48 **Mosier, Andrew P.;** January 30, 2009.
'50 **Nichols, Billy B.;** April 15, 2011.
'50 **Reasor, George A.;** July 13, 2010.
'64 **Barbay, Joseph E.;** no details.
MO Β '42 **Loesing, Vernon T.;** January 22, 1998.
'44 **Nelson, Francis S.;** March 14, 2010.
'54 **Fuller, Thomas R.;** February 21, 2010.
'56 **Sauer Jr., Harry J.;** June 17, 2008.
'61 **Grechus, Garland K.;** December 12, 2010.
MO Γ '41 **O'Connell, Robert F.;** December 26, 2010.
'43 **Bashkow, Theodore R.;** December 23, 2009.
'44 **Miller, David R.;** October 24, 2010.
'50 **Fariss, Robert H.;** September 21, 2010.
'71 **Menendez, Ronald C.;** no details.
MT Α '44 **Durnford, Robert F.;** no details.
'47 **Hinton, Clyde B.;** August 30, 2009.
'48 **Quammen, Wallace R.;** October 4, 2009.
NE Α '75 **Cederberg, Alvin R.;** September 8, 2006.
NH Α '61 **Courtney, Galen R.;** no details.
NJ Α '36 **Gellert, Theodore S.;** August 19, 2009.
'51 **Black, Alexander A.;** October 22, 2010.
'51 **Swensen, John H.;** no details.
NJ Β '43 **Connor, Myles J.;** July 17, 2007.
NJ Γ '36 **Jones, Donald B.;** no details.
'47 **Martini Jr., Herman E.;** February 25, 2011.
'48 **Hopper, Leroy A.;** July 26, 2009.
NJ Δ '41 **Alexander, William B.;** no details.
NM Α '85 **Wemple, Jeffrey A.;** January 22, 2011.
NY Β '51 **Bronson, Donald R.;** no details.
NY Γ '40 **Lounsbury Jr., Charles W.;** February 12, 2011.
'43 **Reynolds, Luther S.;** January 23, 2011.
'60 **Taylor, Stuart B.;** February 18, 2004.
'62 **Eber, Richard D.;** July 20, 2010.
NY Ε '40 **Piasecki, Frank N.;** February 11, 2008.
'50 **Cushing, Arthur L.;** no details.
NY Η '47 **Kane, Harrison;** August 3, 2007.
'50 **Scala, Sinclaire M.;** February 19, 2011.
NY Θ '43 **Bennetts, J. Lawry;** March 14, 2011.
'49 **Petro, Louis G.;** March 25, 2011.
NY Ι '40 **Gordon, Robert;** January 18, 2007.
'50 **Homburger, Wolfgang S.;** June 9, 2010.
'64 **Blumenthal, Stanley M.;** February 2, 2011.
NY Ν '50 **Fish, Howard C.;** August 26, 2004.
NY Ρ '51 **Bugliarello-Wondrich, George;** February 18, 2011.
NC Α '40 **Stansbury, E. Eugene;** February 19, 2011.
'51 **Fulton, Jonathan W.;** March 12, 2010.
NC Γ '44 **Alperin, Alfred M.;** October 31, 2010.
NC Δ '56 **DeHoff, Paul H.;** no details.
ND Α '48 **Engen, John K.;** September 7, 2006.
'51 **Huntley, W. Richard;** March 20, 2011.
OH Α '43 **Werkman, Stephen S.;** November 27, 2010.
'50 **Brotzen, Franz R.;** May 25, 2010.
OH Β '43 **Bylund, Linton D.;** May 26, 2010.
'49 **Yost, Betty J.;** July 6, 2004.
'54 **Chato, John C.;** November 16, 2010.
OH Γ '44 **Harris, William R.;** no details.
'51 **Kerr, Robert H.;** March 10, 2009.
'52 **Walden, Philip A.;** March 11, 2006.

In Memory

Dr. William L. Grecco, P.E., *Pennsylvania Lambda '51,* Tau Beta Pi Executive Councillor during 1990-94, died on April 12, 2011. He received



his B.S. and M.S. in civil engineering from the University of Pittsburgh and his Ph.D. from Michigan State University. During World War II he served in the U.S. Navy. A consultant and author of more than 50 technical papers, he taught at his *alma mater*, at Purdue University, and at the University of Tennessee, where he served as department head for 14 years and retired as associate dean of engineering. A member of the Great Smoky Mountains Alumnus Chapter, Bill was a registered professional engineer, a fellow of the Institute of Transportation Engineers and ASCE (and board member), and served ABET in various positions.

'53 **Kutchera, Richard E.;** December 27, 2010.
'55 **Davison, Paul H.;** September 17, 2009.
'59 **George, Kingston A.;** July 24, 2010.
OH Δ '48 **Brown Jr., John L.;** February 20, 2011.
'57 **Sack, John M.;** April 27, 2008.
OH Θ '67 **Lucas, Gerald E.;** February 2, 2007.
OK A '51 **Singleton, Sandy H.;** October 2, 2010.
OK B '73 **Sims, Earl R.;** no details.
OR A '36 **Bayles, Charles C.;** November 9, 2003.
PA A '38 **Marshall, Daniel Q.;** no details.
PA B '52 **Young, John E.;** January 2, 2011.
'53 **Vernon, Shirley J.;** February 27, 2011.
'58 **Eleftherion, Michael P.;** April 21, 2011.
PA Γ '41 **Winer, Bernard B.;** March 25, 2007.
'54 **McKelvey, William J.;** June 27, 2010.
PA E '43 **Scheffy, Robert W.;** February 24, 2011.
'49 **Kalnoskas, Lawrence F.;** March 19, 2006.
'53 **Reimel, Glenn L.;** February 11, 2011.
PA Z '43 **Rumpf, John L.;** March 17, 2011.
'48 **Piccone, Domenic J.;** February 16, 2011.
'63 **Grant, Robert M.;** August 28, 2008.
PA H '53 **Klemm, Richard H.;** January 11, 2009.
'74 **Kenamond, David L.;** June 17, 2009.
PA Θ '50 **Doyle, Joseph E.;** October 26, 2009.
'76 **Hicks, Joseph S.;** December 29, 2009.
PA I '49 **Richards, Robert L.;** September 12, 2008.
PA Λ '47 **Grecco, William L.;** April 12, 2011.
RI A '80 **Tsuyuki, Glenn T.;** no details.
RI B '72 **Kosior, Stefan S.;** September 22, 2008.
SC A '61 **Lippy, Edwin C.;** March 24, 2009.
SC B '52 **Blodgett Jr., Donald;** January 2, 2011.
'63 **Lee, Danny W.;** September 15, 2010.
SC Γ '50 **Howe Jr., Joseph G.;** November 1, 2009.
'64 **Unterspan, John A.;** March 8, 2001.
SD A '70 **Stechmann, Eric L.;** April 8, 2011.
TN A '50 **Morgan, Harry T.;** February 15, 2011.
'52 **Courtney, Clinton C.;** no details.
'65 **Kebschull, William D.;** March 12, 2011.
TX A '35 **Kerr, Donald M.;** November 8, 1994.
'40 **Gueldner Jr., Louis O.;** March 8, 2010.
'44 **Focht Jr., John A.;** October 22, 2010.
'49 **Boston, William G.;** May 2, 1988.
'49 **Swanzy Jr., Hubert A.;** August 30, 2010.
'51 **Ayres, Joe A.;** July 15, 2010.
'51 **Wilde, Wilford C.;** December 9, 2007.
'59 **Konde, Eugene R.;** October 14, 2006.
'60 **Cline, James C.;** no details.
'83 **Taylor, Neale H.;** February 19, 2011.
TX B '52 **Wilson, Delton A.;** no details.
TX E '74 **Alves, Gerald W.;** October 20, 2005.
TX H '07 **Symank, Paul A.;** December 14, 2010.
UT A '48 **Bailey, Gordon W.;** September 14, 2010.
'51 **Clyde, Calvin G.;** no details.
'53 **Horrocks, Robert R.;** no details.
VA B '59 **Grayson, Thomas C.;** February 10, 2010.
WA A '67 **Garland, James B.;** May 1, 2009.
WA B '42 **Pierce, Leo R.;** no details.
'50 **Munk, Edward F.;** no details.
'53 **Manetsch, Thomas J.;** January 1, 2011.
'59 **Davenport, Leslie C.;** January 5, 2011.
'81 **Franck, Wade A.;** May 18, 2009.
WV A '49 **Kester Jr., Granville;** January 17, 2007.
'51 **Moody Sr., George H.;** February 22, 2011.
'58 **Douglas, Charles L.;** no details.
WI A '48 **Griem, Melvin L.;** February 7, 2011.
'70 **Schaefer, Phillip T.;** March 16, 2011.
WI B '31 **Halbach, Edward A.;** March 20, 2011 *[Centenarian 74]*
'50 **Marx, Arthur J.;** February 14, 2005.
'50 **Payzer, Robert J.;** December 21, 2010.
'51 **Bold, Norbert T.;** November 2010.
ΣT Ξ '53 **Rosen, Herbert H.;** October 25, 1996.

Corrections:
Alive and well, Michael J.Crosbie, *DC B '78*, and John W. Heimaster, *OH Γ '67*, were incorrectly added to Chapter Eternal.

TBΠ Directory

Executive Council

President Larry A. Simonson, Ph.D., P.E., *SD A '69*, SDSM&T Foundation, 501 E. St. Joseph St., Rapid City, SD 57701. *(larry@tbp.org)*

Vice President Solange C. Dao, P.E., *FL A '95*, 305 W. Lake Faith Drive, Maitland, FL 32751 *(solange@tbp.org)*

Councillor Jonathan F.K. Earle, Ph.D., P.E., *FL A '65*, 8516 SW 20th Lane, Gainesville, FL 32607. *(jonathan@tbp.org)*

Councillor Jason A. Huggins, P.E., *FL A '96*, 4701 Hickory Shores Blvd., Gulf Breeze, FL 32563. *(jason@tbp.org)*

Councillor Norman Pih, *TN A '82*, , Flagstaff, AZ 86004. *(norman@tbp.org)*

National Headquarters

Executive Director James D. Froula, P.E., *TN* A *'67*, P.O. Box 2697, Knoxville, TN 37901-2697. *(tbp@tbp.org)*

Cleve's Back!

Cleveland L. Campbell, P.E., *Iowa Alpha '47*, is once again offering to match first-time donations to Tau Beta Pi's Alumnus Giving Program. Any such gift received in 2011(up to $2,000) will be matched dollar-for-dollar, until we reach $25,000. Past challenges of $10K, $12K, and $25K were met and matched.

Cleve's matching funds are used to create new TBΠ-Campbell scholarships. If you are a first-time donor and would welcome Cleve to match your gift, please send a check (write *"Campbell match"* on it) to Tau Beta Pi, P.O. Box 2697, Knoxville, TN 37901-2697, or use a credit card by calling us at 865/546-4578.

Thanks go to Cleve for supporting our scholars and to all loyal donors.

"Mr. and Mrs. Campbell,
Thank you for funding this scholarship. The legacy that you leave is both honorable and long-lasting; it encourages me and my fellow engineers to leave legacies of our own."
—**Joel N. Mehler,** *Kansas Beta '05*
Campbell Scholar No. 4

SPOTLIGHT

Top-Paid Majors
Graduates in 2010-11 with bachelor's degrees in engineering sport top salary offers, according to a National Association of Colleges and Employers survey. The study reveals that engineering majors comprise seven of the top-10 fields on the list of highest paid majors:

1. Chemical Engineering—$66,886
2. Computer Science—$63,017
3. Mechanical Engineering—$60,739
4. Electrical/Electronics & Communications Engineering—$60,646
5. Computer Engineering—$60,112
6. Industrial/Manufacturing Engineering—$58,549
7. Systems Engineering—$57,497
8. Engineering Technology—$57,176
9. Information Sciences & Systems—$56,868
10. Business Systems Networking/Telecommunications—$56,808

Licensure by Discipline?
Should engineers be licensed generally as P.E.s, or should they be licensed in their specific engineering discipline? This question was posed in 2007 during the NSPE annual meeting. The debate has been reignited as structural engineers push to expand separate licensing of their discipline in more jurisdictions and with the introduction of a 16-hour structural engineering exam by the NCEES. The first P.E. licensing law was enacted in Wyoming in 1907. Illinois became the first state to establish a structural-engineering practice act in 1915. California, Hawaii, Idaho, Nebraska, Nevada, New Mexico, Oregon, Utah, and Washington also draw distinctions between structural and other engineers.

P.E. Requirement Appeal
A New York appeals court has dismissed a challenge by the New York State Society of Professional Engineers to void a law that removed the licensure requirement for the commissioner of New York City's department of buildings. The law, which took effect in September 2008, also allows the commissioner to delegate any engineering duties to the deputy commissioner. NYSSPE believes that the law conflicts with state law because the council is permitting a city official to engage in the practice of engineering without a license.

STEM Doctorates
The National Science Foundation reports that two-thirds of all research doctorates awarded in 1999 by U.S. academic institutions were in engineering and science. This represents a 22 percent increase since 1999. Non-science and engineering doctorates rose by 6 percent during this period. The NSF and ASEE databases both registered 40 percent growth in engineering doctorates since 1999.

PEOPLE

Dr. Neville G. Pinto, *Ohio Beta '80,* has been named as dean of the University of Louisville's school of engineering. He has been the University of Cincinnati's vice provost and graduate school dean since 2006 after serving in its college of engineering in various posts, including assistant dean for graduate studies and chemical engineering department chair.

Dr. Michael R. Lovell, *Pennsylvania Lambda '89,* former dean of the college of engineering and applied science at the University of Wisconsin-Milwaukee, has been selected as the university's next chancellor. He had been interim chancellor since October 2010. Dr. Lovell joined UWM in 2008, after five years as associate dean for research at the University of Pittsburgh's school of engineering.

Dr. Ian A. Waitz, *Pennsylvania Beta '86,* professor and head of the department of aeronautics and astronautics, has become the 16th dean of MIT's school of engineering. His principal areas of interest are the modeling and evaluation of climate, local air quality, and noise impacts of aviation.

Dr. Edwin L. Thomas, *Massachusetts Zeta '69,* former chair of the department of materials science and engineering at the Massachusetts Institute of Technology, is the new dean of Rice University's school of engineering. A materials scientist and mechanical engineer, he has spent the past 22 years on the MIT faculty.

Dr. Keith Buffinton, *Massachusetts Delta '79,* has been chosen as dean of the college of engineering at Bucknell University. A mechanical engineering professor there since 1987, he had served as interim dean since 2009. His specialties include robotics and computational analysis.

Dr. Vincent P. Manno, *New York Alpha '75,* associate provost and professor of mechanical engineering at Tufts University, has been appointed provost and dean of faculty at Franklin W. Olin College of Engineering, where he will also serve as professor of engineering.

Dr. Paul C. Johnson, *California Lambda '83,* formerly executive dean of the Arizona State University school of engineering and professor in the school of sustainable engineering and the built environment, has become dean of the engineering schools. A faculty member at ASU since 1994, he previously served as associate vice president for research and as interim dean.

Dr. Kathleen A. Kramer, *California Omicron '86,* director of engineering at the University of San Diego, represented Tau Beta Pi on March 8, 2011, at the inauguration of David W. Burcham as the 15th president of Loyola Marymount University.

Brain Ticklers

RESULTS FROM WINTER 2011

Perfect

*Brule, John D.	MI B '49
Couillard, J. Gregory	IL A '89
Gay, Nicholas J.	KS Γ '09
Griggs Jr., James L.	OH A '56
Jones, John F.	WI A '59
Krook-Magnuson, Chris	Non-member
*Kumar, Vinny P.	PA Δ '09
*Marx, Kenneth D.	OR A '61
*Mayer, Michael A.	IL A '89
Nabutovsky, Joseph	Father of member
*Norris, Thomas G.	OK A '56
Norris Jr., Thomas G.	PA Γ '79
Overton, Leonard L.	IN B '74
Newby, Dan	Nephew of member
*Prince, Lawrence R.	CT B '91
Rasbold, J. Charles	OH A '83
Rosenthal, Jason	Son of member
Rosenthal, Amy	NY N '89
Schmidt, V. Hugo	WA B '51
*Snelling, William E.	GA A '79
*Spong, Robert N.	UT A '58
*Stribling, Jeffrey R.	CA A '92
*Strong, Michael D.	PA A '84
White Jr., Warren N.	LA B '74

Other

Alexander, Jay A.	IL Γ '86
*Anonymous	Unknown
Aron, Gert	IA B '58
Bachmann, David E.	MO B '72
Ballard, Jeffrey A.	FL E '05
Bayne, Stephanie C.	LA Γ '10
Beaudet, Paul R.	Father of member
Becker, William H.	MD A '65
*Berinato, Robert J.	GA A '85
Bertrand, Richard M.	WI B '73
Conway, David B.	TX I '79
deVitry, David M.	PA H '97
Dohner, John W.	CA Γ '72
Forde, Jeffrey M.	CA M '97
Handley, Vernon K.	GA A '86
*Harms, Todd M.	TN A '95
Henry, Jerry R.	MO A '63
Jones, Donlan F.	CA Z '52
Jones, Jesse D.	CA Γ '95
Kane, Ronald J.	MI Γ '74
*Kimsey, David B.	AL A '71
Kneip, Paul M.	IA A '89
Lew, Thomas M.	TX Δ '84
Marks, Lawrence B.	NY I '81
Hertz, Caryn M.	NY I '81
Marks, Benjamin	Son of member
Marks, Noah H.	PA K '11
Marrone, James I.	IN A '61
Mercer, Robert	Non-member
Niemi, Michael G.	MD Γ '07
Quintana, Juan S.	OH Θ '62
Rentz, Peter E.	IN A '55
Rhinehart, Todd M.	CA Y '11
Saikali, Jeffrey	OH B '96
Shah, Parth	Son of member
Silver, Robert E.	NY P '80
Spring, Gary S.	MA Z '82
Stepanian, Shant P.	NJ A '06
Stetson II, Scott B	Son of member
Stevens, Robert E.	MO B '85
Summerfield, Steven L.	MO Γ '85
Sutor, David C.	Son of member
Tessier, Thomas M.	MA A '90
*Thaller, David B.	MA B '93
Twete, Myles A.	OR B '03
*Voellinger, Edward J.	Non-member
Zison, Stanley W.	CA Θ '87

* Denotes correct bonus solution

WINTER REVIEW

Problem 2 (the pirates) was the hardest, and problem 5 (the birds) was the next hardest regular problem.

SPRING SOLUTIONS

Reader entries for the Spring problems will be acknowledged in the Fall BENT. Meanwhile, here are the answers.

1 RNAGEL = 142857. This is the repeating digits of 1/7 = 0.142857142... and has the property that multiplication by 1, 2, 3, 4, 5, or 6 produces the same digits in a different order.

2 The spider catches the ant after 1,005 complete circuits. The length of the spider's circuit is πD cm, and that of the ant is $(\pi/2 + 1)D$ cm, where D is the diameter of the circle. The time required for the spider to complete one circuit is $\pi D/v_s$ min, and the time required for the ant to complete one circuit is $(\pi/2 + 1)D/v_a$ min. The critical issue is the position of the ant at the start of each spider circuit. The ant takes $(\pi D/2)/v_a$ min to traverse the upper semicircle, and the spider takes $(\pi D/2)/v_s$ min. Thus, if the ant is more than $(\pi D/2)(1/v_a - 1/v_s)$ min, or $x = (\pi D/2)(1 - v_a/v_s)$ cm, ahead of the spider at the start of a new spider circuit, the spider will not catch the ant before it escapes along the diameter.

The number of ant circuits equal to n_s spider circuits is $[2\pi/(\pi+2)]n_s(v_a/v_s)$. In general, this will equal a whole number plus a fraction of a circuit. For the spider to catch the ant, the fractional circuit must correspond to one diameter (since the ant starts at the left end of a diameter) plus an amount less than x. That is, we want the fractional part of $[2\pi/(\pi+2)]n_s(v_a/v_s) - 2/(\pi+2)$ to be less than $z = x/[(\pi/2 + 1)D]$. The approach is to try successive values of n_s until z falls in the critical range. (This is easily done on a spreadsheet.) For D = 100 cm, v_a = 700 cm/min, and v_s = 701 cm/min, x = 0.224079362 cm and z = 0.000871634. Thus, we want $1.220287673n_s - 0.388984529$ to be less than 0.000871634. These values with n_s = 1,005 give 1,226 ant cycles plus the equivalent of a diameter plus 0.00012636, which is less than the critical value. Thus, the spider catches the ant on the 1,006th circuit after 1,005 complete circuits. It looks like 660 circuits would work, but careful analysis shows that the ant barely escapes.

3 Doris stocked the shelf with catalogs. Let C, D, and E be the widths of a catalog, dictionary, and encyclopedia, respectively. There are three possibilities: (1) Al and Bob are correct; (2) Al and Connie are correct; or (3) Bob and Connie are correct. If (1), $2C + 3D + 3E = 4C + 3D + 2E$, then $E = 2C$. If (2), $2C + 3D + 3E = 4C + 4D + 3E$, then $D = -2C$. If (3), $4C + 3D + 2E = 4C + 4D + 3E$, then $E = -D$. Since book widths can't be negative, it must be Al and Bob who are correct. Doris can't have used encyclopedias, since then catalogs would also work; therefore, she used catalogs or dictionaries. Assume she used dictionaries; then $2C + 3D + 3(2C) = 8C + 3D = 15D$, so $D = 2C/3$, and $15D = 10C$, so both dictionaries and catalogs would work. Therefore, Doris must have used catalogs. (To see that only catalogs work, note that $2C + 3D + 3(2C) = 15C$, so $C = 3D/7$ and $15C = 45D/7$, and so dictionaries don't work.)

4 There are 144 different arrangements for the cards. Refer to the figure.

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

Place an arbitrary card in position 1 (16 possibilities). Assume it is the ace of spades. Place the other three aces in 7, 12, 14 or 8, 10, 15 (3 aces times 2 positions = 3!(2) = 12 possibilities). The remaining three spades must go in 8, 10, 15 or 7, 12, 14, depending on where the aces were located (3! = 6 possibilities); the rest of the cards are now forced. For each arrangement, there are 4 rotations and 2 reflections. Thus, the total number of different arrangements is 16(12)(6)/8 = 144.

5 Two thirds of the days are sunny, so the expected number of sunny days per year is 2(365)/3 = 243. Let P_r = probability of rain and P_S = probability of sun. Then, $P_r = 0.5P_S$ and $P_S = P_r + 0.5P_S$. Also, $P_S + P_r = 1$. Therefore, $P_S = 1 - P_S + 0.5P_S$. Solving gives $P_S = 2/3$, so the expected number of sunny days is 2(365)/3 = 243.3.

Bonus. For a person standing in the center of a flat face of the cylinder, g_c is 9.83 m/s^2. Let the height of the cylinder be H and its radius be R.

Consider a slice of this cylinder, parallel to its circular faces and of thickness dh, and let the distance of the slice from the top face be h. Now consider a concentric ring of radius r and width dr on this slice.

The volume of this ring is $dV = 2\pi r\,dr\,dh$, and its mass is $dM = 2\pi\rho r\,dr\,dh$, where ρ is density.

The gravitational force of the ring on a mass m located at the center of the top face of the cylinder is $dF = 2\pi\rho Gm\cos\theta\, dM/s^2$, where s is the distance from a point on the concentric ring to the center of the top face and θ is the angle between the centerline of the cylinder and a line from the concentric ring to the center of the top face ($\cos\theta$ is necessary because only the vertical component of the force contributes to g).

Now, $s^2 = r^2 + h^2$, and $\cos\theta = h/s = h/\sqrt{(r^2 + h^2)}$. Therefore, $F = 2\pi\rho Gm\int_0^H\int_0^R hr\,dr\,dh/(r^2 + h^2)^{3/2} = 2\pi\rho Gm\int_0^H[-1/(r^2 + h^2)^{1/2}]|_0^R h\,dh = 2\pi\rho Gm\int_0^H[1/h - 1/(R^2 + h^2)^{1/2}]h\,dh = 2\pi\rho Gm\int_0^H[1 - h/(R^2 + h^2)^{1/2}]dh = 2\pi\rho Gm[h - (R^2 + h^2)^{1/2}]|_0^H = 2\pi\rho Gm[H + R - (R^2 + H^2)^{1/2}]$. Now, $M = \pi R^2 H\rho$, or $\pi\rho = M/R^2H$. Therefore, $F = 2GmM[H + R - (R^2 + H^2)^{1/2}]/R^2H$, but $F = mg_c$, so $g_c = 2GM[H + R - (R^2 + H^2)^{1/2}]/R^2H$, but $H = 2R$, so $g_c = (3 - \sqrt{5})GM/R^2$. Now, the volume of the earth is $V_e = (4/3)\pi R^3 = (4/3)\pi(6.37\text{x}10^6)^3\ \text{m}^3 = 1.0827\text{x}10^{21}\ \text{m}^3$, and its mass is $M_e = 5{,}518V_e = 5.974\text{x}10^{24}$ kg. $V_c = \pi R^2H = 2\pi R^3 = (4/3)\pi R_e^3$, so $R = (2/3)^{1/3}R_e$, or $R = 0.8736\ R_e = 5.565\text{x}10^6$ m. Now, G $= 6.673\text{x}10^{-11}\ \text{m}^3/\text{s}^2$ kg, so $g_c = (3 - \sqrt{5})(6.673\text{x}10^{-11})(5.974\text{x}10^{24})/(5.565\text{x}10^6)^2 = 9.83\ \text{m/s}^2$, surprisingly close to g for a spherical earth.

Computer Bonus. 967,718,839 is the smallest prime P for which the ratio of the number of double primes to the number of primes (both ≤ P) is less than 1/e. There are 49,288,471 primes ≤ P, of which 18,132,215 are double primes, giving a ratio of 0.3678794378; 1/e = 0.367879441.

NEW SUMMER PROBLEMS

1 Al, Bob, Carl, Don, and Ed took a mathematics test with five questions. For a correct answer, 10 points were given; if the answer were wrong, either 7, 2, or 0 points were given, depending on the method used and the way the work was presented. (No points other than 10, 7, 2, or 0 were awarded, and it is perfectly possible for two students to get the same wrong answer, but be given different points.) At least one student got each question right. Some information about the answers of different students is shown in the table.

	1	2	3	4	5
Al	5	?	11	?	4.5
Bob	3.5	17	5	?	3.4
Carl	4	43	5	?	2.8
Don	2.5	17	11	6	3.8
Ed	7	17	7	7	5.2

The total points for Al, Bob, Carl, Don, and Ed were 34, 19, 31, ?, and 9, respectively. The total points for each question, #1 – #5, were 14, 29, 22, 42, and ?. You may also find it helpful to know that Ed got more points for question 5 than Bob. Determine the number of points awarded each student for each question.

—*Brain Puzzler's Delight* by E. R. Emmet

2 2010 was the 75th anniversary of the creation of the WPA, which provided millions of jobs during the Great Depression. Solve the following two cryptic addition problems simultaneously in base 11 (use a lower case *a* to represent the digit 10).

USA + FDR = WPA
USA + WPA = PARK

Different letters represent different digits, the same letter always represents the same digit, and there are no leading zeros.

—**Howard G. McIlvried III,** *PA Γ '53*

3 In a game of 7-card stud poker with deuces wild, what is the probability of getting five of a kind?

—**Howard G. McIlvried III,** *PA Γ '53*

4 Twenty-six identical coins lie on a table—ten heads and 16 tails. Blindfolded, you are told to divide the coins into two groups with the same number of heads in each group. You may move the coins and turn them over, but have no way of telling whether a coin is heads or tails. How do you accomplish this?

—*All-Star Mathlete Puzzles* by **Richard I. Hess,** *CA B '62*

5 Any number, real or complex, may be represented in the form $r(\cos\theta + i\sin\theta)$. Considering values of θ only in the range -π to +π radians, determine whether i to the ith to the ith to the ith power, ad infinitum, approaches a limit, and, if so, provide r and θ to 4 digits. As a reminder of standard practice, note, for example, that 3 to the 3rd to the 3rd means 3^{27}, and not 27^3. That is, the continued exponential is evaluated from the top down, not from the bottom up.

—**John W. Langhaar,** *PA A '33*

Bonus. Given a 2x4 rectangle of squares (a map) with the front marked with the digits

1	2	3	4
5	6	7	8

and the back marked with letters:

d	c	b	a
h	g	f	e

(that is, the Nth letter of the alphabet is on the back of the square with the digit N).

This 2x4 map can be folded (which includes tucks) along the boundaries between squares in many ways to end with a 1x1 by 8 layers configuration with the '1' square on top of the other seven and the '1' visible. For example, abcd folded onto efgh, 78 folded onto 65, and 3 folded onto 4, ends up with the configuration: 1e8d3g6b. How many unique final configurations can be achieved, and what are they? To make grading easier, please provide the configurations, one per line, sorted

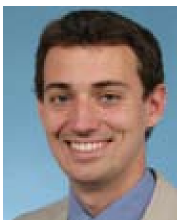
(Continued on page 47

California Upsilon

Baldwin B. Chiu, P.E., **'98,** under the name Only Won—The Lyrical Engineer, has released a music video "I Wanna Be An Engineer—(Billionaire Geeked Out Mix)." This followed his album, which was featured on the cover of *PC Magazine*. The bilingual Asian-American hip-hop artist also works as an actor, martial-arts specialist, and mechanical engineer.

Florida Alpha

Austin D. Cooley, '08, (below) and **Richard L. Winslow, '09,** are running Youtorial, Inc., "to revolutionize how people learn to use software." Cooley, a 2008 Tau Beta Pi Laureate, is founder and CEO, while Winslow, a 2009 TBΠ Fellow now pursuing a Ph.D. at the University of California, Berkeley, is design lead. Cooley has been chosen by Kauffman Labs for Enterprise Creation as one of the 2011 education ventures founders and will receive special training and help to bring his idea to market.



Iowa Alpha

Dr. Daniel W. Black, '86, is professor of physical and engineering sciences, and chair of the department of chemistry and engineering science at Wartburg College in Waverly, IA. He has taught in higher-education institutions since 1991 and previously was an engineer for the McDonnell Aircraft Company.

Kentucky Alpha

Dr. Donald C. Slack, P.E., **'68,** was awarded an honorary doctorate by Khon Kaen University in Thailand in recognition of his role as a founding member of its agricultural engineering department. Dr. Slack is professor of agricultural and biosystems engineering and watershed management and eco-hydrology at the University of Arizona.

Massachusetts Zeta

Luis N. Coimbra, '80, is general manager, marketing and transportation, for the Eurasia business unit of Chevron, in London.

Thomas J. Gajewski, '90, is head of the school of business at Westwood College's Los Angeles campus, responsible for more than 150 students and 13-plus faculty.

Michigan Gamma

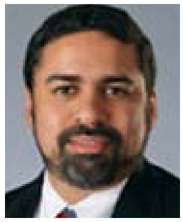
Dr. Arrigo L. Frisiani, '62, has retired after more than 40 years as a professor of computer engineering at the University of Genoa, Italy. He led the establishment and development of the computer engineering curriculum at the university and was a founding member of the Italian association of computer engineering professors. He continues to lecture and collaborate with the university's college of engineering.

Michigan Eta

Robert M. Ferer, '90, has been named winner of the SAE International Bill Agnew award for outstanding AWIM volunteers. He is program engineering manager in the full-size truck program at General Motors. The award recognizes volunteers who further develop students' abilities in math and science by helping teachers use SAE's A World In Motion® (AWIM) materials. These offer interdisciplinary, project-based learning to students in kindergarten through high school.

New Jersey Beta

Rajiv Datta, '93, has become chief operating officer for AboveNet, Inc., a provider of high-bandwidth connectivity solutions. He now oversees the operations, sales, marketing, IT, product, and engineering divisions and is also responsible for operations in Europe. Datta previously held various engineering and development positions at Alcatel.



New Jersey Delta

Robert J. Hotes, '85, has been selected by the American Architectural Foundation and the French Heritage Society as the 2011 Richard Morris Hunt fellow. The six-month fellowship is awarded to architects working in historic preservation. Hotes is a senior associate at John Milner Architects, Inc., in Philadelphia, PA. He intends to study *compatibility* and *differentiation* as adopted in France for new design in historic contexts.

New York Gamma

Dr. John P. Veldman, P.E., **'70,** has retired as associate laboratory director for National and Homeland Security after 21 years at Savannah River National Laboratory. He held positions in research and development, project management, and operations and has been responsible for a $100M/year portfolio of technology programs for defense, nonproliferation, and homeland security applications. Dr. Veldman was previously employed by DuPont.

New York Mu

Dr. Thomas C. Sheahan, P.E., **'81,** has been named as senior associate dean

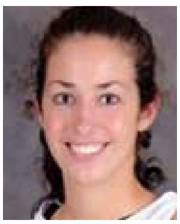
for academic affairs at Northeastern University's college of engineering. He has been on the faculty there since 1991 and is the 2007 Tau Beta Pi-McDonald Mentor. He has also been active in organizations including ASME and Engineers Without Borders.

New York Nu

Mark A. Noblett, P.E., **'70,** has retired as a civilian from the U.S. Air Force at Andrews AFB. He served as chief of engineering with the civil engineer squadron. He previously served with the U.S. Army Corps of Engineers, Baltimore district, supporting projects in Bosnia and Afghanistan.

New York Upsilon

Erin E. Anthony, '11, continued to solidify her position as a top student-athlete when



she repeated as a first team Capital One academic all-America basketball selection for 2011. A two-time defending Patriot League scholar-athlete of the year, Anthony was also a first team academic all-America honoree in 2010. She is the fourth honoree in back-to-back years in her league's 20-year history and first to make the top team twice.

Ohio Lambda

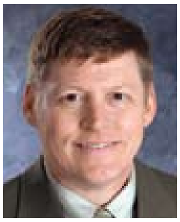
Jerad R. Shuster, '00, and his wife Jennifer welcomed their third child on April 7, 2011. Sydney Julia joins sister Alexis Lily and brother Logan Andrew. Jerad is the supervisor of the industrial engineering lab at Diebold, Inc., in North Canton, OH. The family resides in Canfield, OH.

Pennsylvania Alpha

Catherine G. Gorzkowski, '00, and **Dr. Edward P. Gorzkowski III, '99,** have welcomed Edward James Gorzkowski IV, born at a healthy 10 lb. 2 oz. and 21.5 inches. Abigail is loving being a big sister. Catherine is an Engineering Futures Facilitator, and Ed is a District 3 Director.

Texas Delta

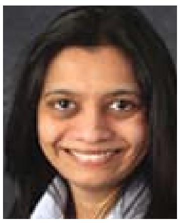
Dr. Dale A. Cope, '82, has been elected an associate fellow of the American



Institute of Aeronautics and Astronautics. He is a program manager in Southwest Research Institute's mechanical engineering division. Cope has more than 20 years of experience in aircraft-structure technology. Prior to joining his firm in 2007, he was a laboratory director at the National Institute for Aviation Research. Cope is a retired U.S. Air Force officer.

Texas Iota

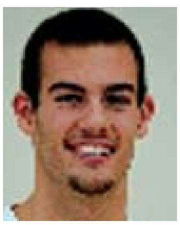
Nita K. Patel, P.E., **'95,** has been named 2011 New Hampshire engi-



neer of the year by the NH Joint Engineering Societies and selected as a candidate for 2012 IEEE-USA president elect. She is the current institute VP of communications and public awareness, an engineering manager at L-3 Insight Technology, and lives in Bedford, NH.

Wisconsin Delta

Austin A. Meier, '12, has been named Capital One men's basketball college



division academic all-America of the year. An architectural engineering and construction management major with a G.P.A. of 3.9, he is a senior forward for the MSOE Raiders. The previous season, Meier was selected to the CoSIDA academic all-America first team.

BRAIN TICKLERS

(Continued from page 45.)

in ascending order (digits less than letters and using only the marks on the upper surfaces) using the above numbering system.

—**Fred J. Tydeman,** *CA Δ '73*

Double Bonus. Consider a quadrilateral. Construct a square on each of its sides. Prove that the two line segments joining the centers of opposite squares are equal in length and mutually perpendicular.

—**Jan Smit,** *CA Δ '41*

Postal mail your answers to any or all of the Brain Ticklers to Jim Froula, **Tau Beta Pi, P. O. Box 2697, Knoxville, TN 37901-2697,** or email to *BrainTicklers@tbp.org* plain text (no HTML, no attachments). The cutoff date for entries to the Summer column is the appearance of the Fall Bent during early October. The method of solution is not necessary, unless you think it will be of interest to the judges. We also welcome any interesting new problems that may be suitable for use in the column. The Double Bonus is not graded. Jim will forward your entries to the judges, who are: **H.G. McIlvried III,** *PA Γ '53;* **D.A. Dechman,** *TX A '57*; **J.L. Bradshaw,** *PA A '82*; and the columnist for this issue,

—**F.J. Tydeman,** *CA Δ '73*

Write Your Own Alumnus Note!

Your fellow Tau Bates are interested in news about you. Send items about civic activities, honors won, weddings, births, promotions, changes in address, etc. to Tau Beta Pi, Box 2697, Knoxville, TN 37901-2697 or to *alumnote@tbp.org.* Material for publication must be received for the **Fall** issue by August 1, **Winter** issue by November 1, **Spring** issue by February 1, and **Summer** issue by May 1. Include name, address, chapter, class year, and email address or phone no. Thank you!

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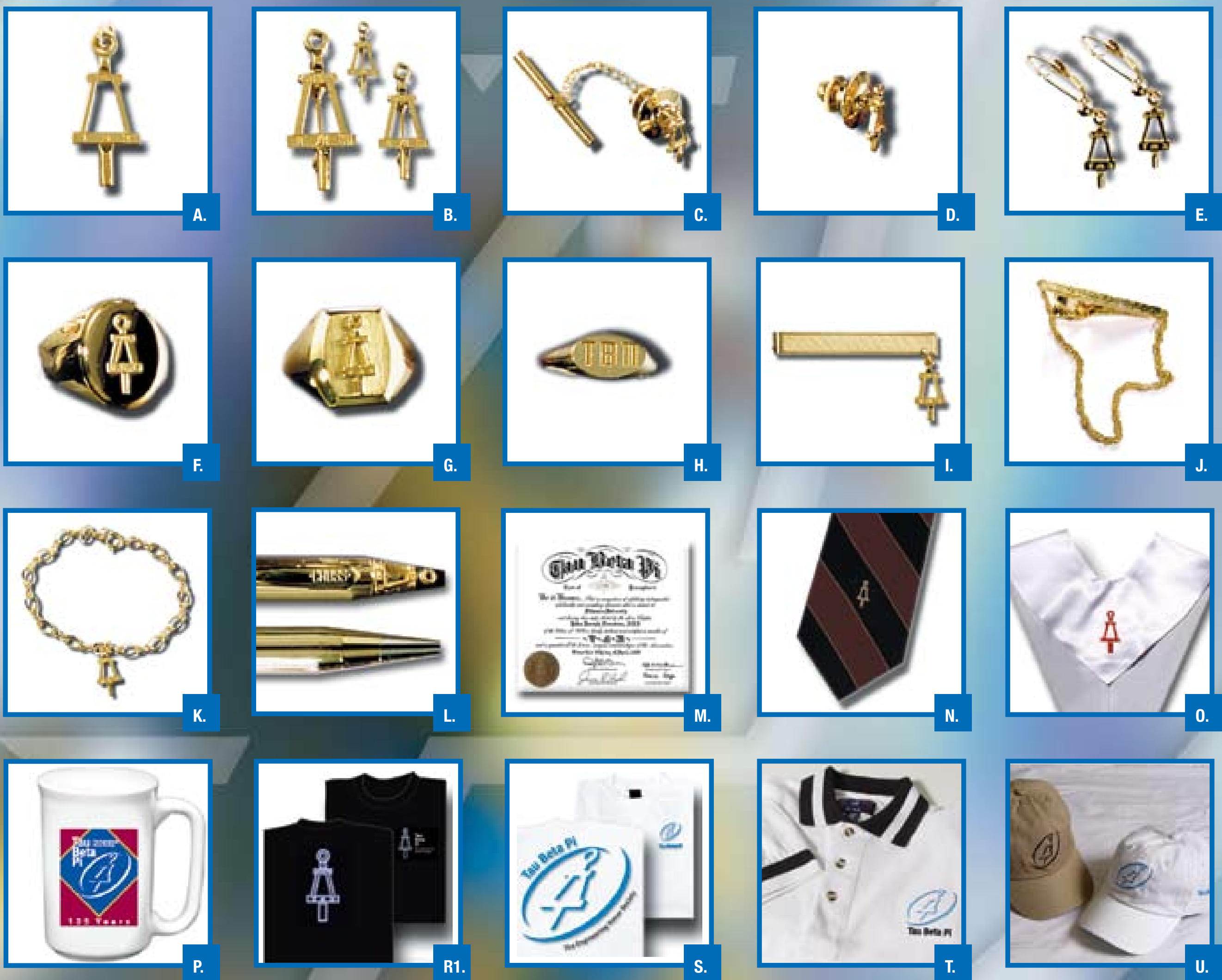

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Union Station, Indianapolis, IN

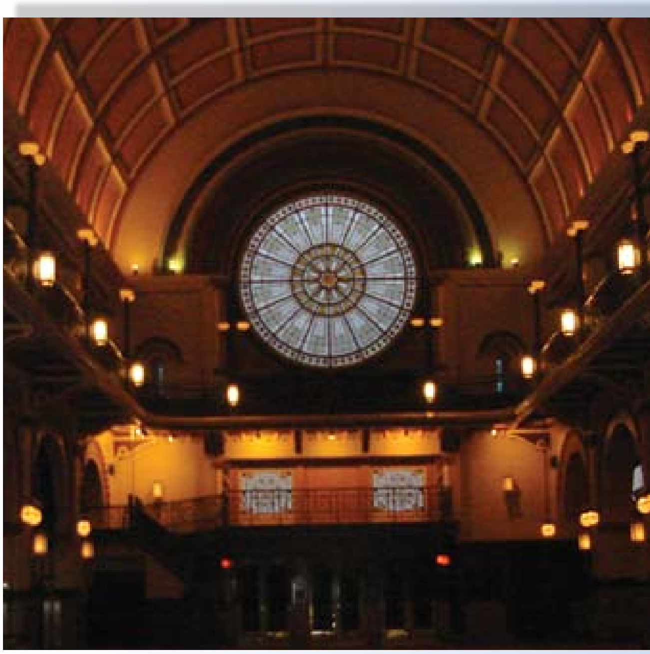
The Indiana Chapters Welcome

2011 TAU BETA PI CONVENTION

MEET IN THE MIDDLE, TAU BATES! INDIANAPOLIS WILL be the site of the 106th annual Tau Beta Pi Convention on October 27-29, 2011. All five Indiana chapters are collaborating and are proud hosts to attendees arriving from as far away as Alaska. The most recent Convention in the state was hosted by Indiana Alpha in West Lafayette in 1996.

Those who arrive at the Indianapolis Airport will be greeted by representatives of the host chapters. Transportation will be provided for a 20-minute drive to the Crowne Plaza at Historic Union Station and the Omni Severin Hotel, where all conventioneers will stay, and events, including business meetings, Engineering Futures and ICE sessions, installation of the new Executive Director, and informative seminars, will be held.

Representatives from dozens of graduate schools of engineering and well known corporations will be available at a Recruiting Fair in the Crowne Plaza from 9 a.m. to 3 p.m. on Thursday, October 27. Be sure to bring copies of your résumé and your chapter's résumé book! You may even skip the Convention if you live nearby and wish to attend only the fair.



On Saturday, the model initiation will be held in the hotel, after which students will have time to explore the city.

Expenses of one student delegate per chapter and a few selected alternate delegates—and the on-site expenses of chapter advisors—will be paid by the Association. Other non-voting delegates and all alumni are welcome, encouraged, and invited to attend at their own expense.

Information is available at *www.tbp.org*, and you may register online at *www.tbp.org/tbpconv*. You may contact Headquarters by email at *convention@tbp.org*. Phone: 865/546-4578 or Fax: 865/546-4579.

Tau Beta Pi's 2011 Convention promises to be an opportunity to learn more about Tau Beta Pi and the wonderful people who make it great. Members of the five Indiana Chapters feel a well-deserved honor in hosting the event and will be ready and eager to make your stay memorable! We invite you to enjoy the campus, develop new friendships for life, and experience this Midwestern environment.