

# THE BENT

OF TAU BETA PI

The Engineering Honor Society

Spring 2019

**TRASH:**  
Working for  
Zero Waste



**Women's Struggle to  
Full Membership**

## Collegiate Chapters (254)

Chap.	Dist.	Institution
AL A	6	Auburn Univ.
AL B	6	Univ. of Alabama
AL G	6	Univ. of Ala. at Birmingham
AL Δ	6	Univ. of Ala. in Huntsville
AL E	6	Univ. of South Alabama
AK A	14	Univ. of Alaska Fairbanks
AZ A	13	Univ. of Arizona
AZ B	13	Arizona State Univ.
AZ G	13	Northern Arizona Univ.
AZ Δ	13	Embry-Riddle Aero. Univ., Prescott
AR A	9	Univ. of Arkansas
CA A	15	Univ. of California, Berkeley
CA B	16	California Inst. of Technology
CA G	15	Stanford Univ.
CA Δ	16	Univ. of Southern California
CA E	16	Univ. of California, Los Angeles
CA Z	15	Santa Clara Univ.
CA H	15	San Jose State Univ.
CA Θ	16	California State Univ., Long Beach
CA I	16	California State Univ., Los Angeles
CA K	16	California State Univ., Northridge
CA A	15	Univ. of California, Davis
CA M	15	Calif. Poly. St. Univ., San Luis Obispo
CA N	16	California State Poly. Univ., Pomona
CA Z	16	San Diego State Univ.
CA O	16	Loyola Marymount Univ.
CA Π	16	Northrop Univ. (inactive)
CA P	15	California State Univ., Fresno
CA Σ	16	Univ. of California, Santa Barbara
CA T	16	Univ. of California, Irvine
CA Y	15	California State Univ., Sacramento
CA Φ	15	Univ. of the Pacific
CA X	16	California State Univ., Fullerton
CA Ψ	16	Univ. of California, San Diego
CA Ω	16	Harvey Mudd College
CA AA	15	California State Univ., Chico
CA AB	16	Univ. of California, Riverside
CA AT	15	San Francisco State Univ.
CA AA	15	Univ. of California, Santa Cruz
CA AE	16	Univ. of San Diego
CO A	12	Colorado School of Mines
CO B	12	Univ. of Colorado at Boulder
CO G	12	Univ. of Denver
CO Δ	12	Colorado State Univ.
CO E	12	Univ. of Colorado at Denver
CO Z	12	United States Air Force Academy
CT A	1	Yale Univ.
CT B	1	Univ. of Connecticut
CT G	1	Univ. of Hartford
DE A	3	Univ. of Delaware
DC A	4	Howard Univ.
DC B	4	Catholic Univ. of America
DC G	4	George Washington Univ.
FL A	5	Univ. of Florida
FL B	5	Univ. of Miami
FL G	5	Univ. of South Florida
FL Δ	5	Univ. of Central Florida
FL E	5	Florida Atlantic Univ.
FL Z	5	Florida Inst. of Technology
FL H	5	Florida A&M Univ.-Florida State Univ.
FL Θ	5	Florida International Univ.
FL I	5	Embry-Riddle Aeronautical Univ.
GA A	5	Georgia Inst. of Technology
GA B	5	Mercer Univ.
ID A	14	Univ. of Idaho
ID B	12	Idaho State Univ.
ID G	12	Boise State Univ.
ID Δ	12	Brigham Young University-Idaho
IL A	8	Univ. of Illinois at Urbana-Champaign
IL B	8	Illinois Inst. of Technology
IL G	8	Northwestern Univ.
IL Δ	8	Bradley Univ.
IL E	8	Southern Illinois Univ. at Carbondale
IL Z	8	Univ. of Illinois at Chicago
IN A	8	Purdue Univ.
IN B	8	Rose-Hulman Inst. of Technology
IN G	8	Univ. of Notre Dame
IN Δ	8	Valparaiso Univ.
IN E	8	Trine Univ.
IN Z	8	Indiana Univ.-Purdue Univ. Indianapolis
IA A	11	Iowa State Univ.
IA B	11	Univ. of Iowa
KS A	9	Univ. of Kansas
KS B	9	Wichita State Univ.
KS G	9	Kansas State Univ.
KY A	6	Univ. of Kentucky
KY B	6	Univ. of Louisville
KY G	6	Western Kentucky Univ.
LA A	10	Louisiana State Univ.
LA B	10	Tulane Univ.
LA G	10	Louisiana Tech Univ.
LA Δ	10	Univ. of Louisiana at Lafayette
LA E	10	Univ. of New Orleans
ME A	1	Univ. of Maine
MD A	4	Johns Hopkins Univ.
MD B	4	Univ. of Maryland
MD G	4	United States Naval Academy
MD Δ	4	Univ. of Maryland Baltimore County
MD E	4	Morgan State Univ.
MA A	1	Worcester Polytechnic Inst.
MA B	1	Massachusetts Inst. of Technology
MA G	1	Harvard Univ. (inactive)
MA Δ	1	Tufts Univ.
MA E	1	Northeastern Univ.
MA Z	1	Univ. of Massachusetts at Amherst
MA H	1	Boston Univ.
MA Θ	1	Univ. of Massachusetts Lowell
MA I	1	Western New England Univ.
MI A	7	Michigan State Univ.
MI B	11	Michigan Tech. Univ.
MI G	7	Univ. of Michigan
MI Δ	7	Univ. of Detroit Mercy
MI E	7	Wayne State Univ.
MI Z	7	Kettering Univ.
MI H	7	Lawrence Technological Univ.
MI Θ	7	Oakland Univ.
MI I	7	Univ. of Michigan-Dearborn
MI K	7	Western Michigan Univ.
MI A	7	Grand Valley State Univ.

Chap.	Dist.	Institution
UNiv.	11	Univ. of Minnesota-Twin Cities
MN B	11	Univ. of Minnesota, Duluth
MS A	6	Mississippi State Univ.
MS B	6	Univ. of Mississippi
MO A	9	Univ. of Missouri-Columbia
MO B	9	Missouri Univ. of Science & Technology
MO G	9	Washington Univ.
MO Δ	9	Univ. of Missouri-Kansas City
MO E	9	Saint Louis University
MT A	12	Montana State Univ.
MT B	12	Montana Tech of the Univ. of Montana
NE A	9	Univ. of Nebraska-Lincoln
NV A	15	Univ. of Nevada, Reno
NV B	16	Univ. of Nevada, Las Vegas
NH A	1	Univ. of New Hampshire
NH B	1	Dartmouth College
NJ A	2	Stevens Inst. of Technology
NJ B	2	Rutgers Univ.
NJ G	2	New Jersey Inst. of Technology
NJ Δ	2	Princeton Univ.
NJ E	2	Rowan Univ.
NJ Z	2	The College of New Jersey
NM A	13	New Mexico State Univ.
NM B	13	Univ. of New Mexico
NM G	13	New Mexico Inst. of Mining & Tech.
NY A	2	Columbia Univ.
NY B	2	Syracuse Univ.
NY G	2	Rensselaer Polytechnic Inst.
NY Δ	2	Cornell Univ.
NY E	2	New York Univ. (inactive)
NY Z	2	Polytechnic Inst. of Brooklyn (inactive)
NY H	2	City College of CUNY
NY Θ	2	Clarkson Univ.
NY I	2	Cooper Union School of Engineering
NY K	2	Univ. of Rochester
NY A	2	Pratt Inst. (inactive)
NY M	2	Union College
NY N	2	SUNY at Buffalo
NY Z	2	Manhattan College
NY O	2	SUNY at Stony Brook
NY P	2	Rochester Inst. of Technology
NY B	2	Polytechnic Institute of New York Univ.
NY Σ	2	Alfred Univ.
NY T	2	Binghamton University
NY Y	2	United States Military Academy
NC A	4	North Carolina State Univ.
NC B	4	Univ. of N.C. at Chapel Hill (inactive)
NC G	4	Duke Univ.
NC Δ	4	Univ. of North Carolina at Charlotte
NC E	4	North Carolina A&T State Univ.
NC Z	4	East Carolina University
ND A	11	North Dakota State Univ.
ND B	11	Univ. of North Dakota
OH A	7	Case Western Reserve Univ.
OH B	7	Univ. of Cincinnati
OH G	7	Ohio State Univ.
OH Δ	7	Ohio Univ.
OH E	7	Cleveland State Univ.
OH Z	7	Univ. of Toledo
OH H	7	Air Force Inst. of Technology
OH Θ	7	Univ. of Dayton
OH I	7	Ohio Northern Univ.
OH K	7	Univ. of Akron
OH A	7	Youngstown State Univ.
OH M	7	Wright State Univ.
OH N	7	Cedarville Univ.
OH Σ	7	Miami Univ.
OK A	9	Univ. of Oklahoma
OK B	9	Univ. of Tulsa
OK G	9	Oklahoma State Univ.
OR A	14	Oregon State Univ.
OR B	14	Portland State Univ.
OR G	14	Univ. of Portland
OR Δ	14	Oregon Institute of Technology
PA A	3	Lehigh Univ.
PA B	3	Pennsylvania State Univ.
PA G	3	Carnegie Mellon Univ.
PA Δ	3	Univ. of Pennsylvania
PA E	3	Lafayette College
PA Z	3	Drexel Univ.
PA H	3	Bucknell Univ.
PA Θ	3	Villanova Univ.
PA I	3	Widener Univ.
PA K	3	Swarthmore College
PA A	3	Univ. of Pittsburgh
PA M	3	Penn State Erie, The Behrend College
PR A	5	Univ. of Puerto Rico
RI A	1	Brown Univ.
RI B	1	Univ. of Rhode Island
SC A	5	Clemson Univ.
SC B	5	Univ. of South Carolina
SC G	5	The Citadel
SD A	12	South Dakota School of Mines & Tech.
SD B	11	South Dakota State Univ.
TN A	6	Univ. of Tennessee
TN B	6	Vanderbilt Univ.
TN G	6	Tennessee Tech. Univ.
TN Δ	6	Christian Brothers Univ.
TN E	6	Univ. of Memphis
TN Z	6	Univ. of Tennessee at Chattanooga
TX A	10	Univ. of Texas at Austin
TX B	13	Texas Tech Univ.
TX G	10	Rice Univ.
TX Δ	10	Texas A & M Univ.
TX E	10	Univ. of Houston
TX Z	10	Lamar Univ.
TX H	10	Univ. of Texas at Arlington
TX Θ	13	Univ. of Texas at El Paso
TX I	10	Southern Methodist Univ.
TX K	10	Prairie View A & M Univ.
TX A	10	Texas A & M Univ.-Kingsville
TX M	10	Univ. of Texas at San Antonio
TX N	10	Univ. of Texas Rio Grande Valley
UT A	12	Univ. of Utah
UT B	12	Brigham Young Univ.
UT G	12	Utah State Univ.
VT A	1	Univ. of Vermont
VT B	1	Norwich Univ.
VA A	4	Univ. of Virginia
VA B	4	Virginia Polytechnic Inst. & State Univ.

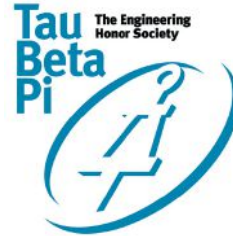
Chap.	Dist.	Institution
VA G	4	Old Dominion Univ.
VA Δ	4	Virginia Military Inst.
VA E	4	Virginia Commonwealth Univ.
WA A	14	Univ. of Washington
WA B	14	Washington State Univ.
WA G	14	Seattle Univ.
WA Δ	14	Gonzaga Univ.
WV A	4	West Virginia Univ.
WV B	4	West Virginia Univ. Inst. of Technology
WI A	8	Univ. of Wisconsin-Madison
WI B	8	Marquette Univ.
WI G	8	Univ. of Wisconsin-Milwaukee
WI Δ	8	Milwaukee School of Engineering
WI E	8	Univ. of Wisconsin-Platteville
WY A	12	Univ. of Wyoming



## Alumni Chapters (78)

- District 1**
- Central Connecticut, Hartford
  - Greater Boston Area, MA
- District 2**
- Buffalo, NY
  - Central Jersey, NJ
  - Long Island Suburban, NY
  - Newark, NJ
  - New York City, NY
  - New York Capital District, NY
  - Rochester, NY
  - Southern Tier, Binghamton, NY
- District 3**
- Lehigh Valley, Bethlehem, PA
  - Philadelphia, PA
  - Pittsburgh, PA
  - Wilmington, DE
- District 4**
- Baltimore, MD
  - Hampton Roads, Newport News, VA
  - Kanawha Valley, Charleston, WV
  - Research Triangle, Durham-Chapel Hill-Raleigh, NC
  - Richmond, VA
  - Washington, DC
- District 5**
- Atlanta, GA
  - Central Florida, Orlando
  - Daytona Beach, FL
  - Gainesville, FL
  - Miami, FL
  - Midlands, Columbia, SC
  - Palm Beach/Broward, FL
  - Piedmont, Clemson, SC
  - Puerto Rico
  - Tampa Bay, FL
- District 6**
- Bluegrass, Lexington-Frankfort, KY
  - Central Alabama, Birmingham
  - Great Smoky Mountains, Knoxville-Oak Ridge, TN
  - Greater Gulf Coast, Mobile, AL
  - Louisville, KY
  - Mid-South, Memphis, TN
  - Rocket City, Huntsville, AL
- District 7**
- Ann Arbor Area, MI
  - Central Michigan, Lansing
  - Cincinnati, OH
  - Columbus, OH
  - Dayton, OH
  - Flint, MI
  - Ohio's North Coast, Cleveland
  - Southeastern Michigan, Detroit
  - West Michigan, Grand Rapids
- District 8**
- Chicago Area, IL
  - Central Illinois, Urbana-Champaign
  - Indianapolis, IN
  - Milwaukee Area, WI
- District 9**
- Pioneer, OK
  - Rolla, MO
  - St. Louis, MO
- District 10**
- Central Texas (Austin/San Antonio)
  - North Texas (Dallas-Fort Worth)
  - Greater New Orleans, LA
  - Texas Gulf Coast, Houston
- District 11**
- Ames, IA
  - Minnesota, Twin Cities, MN
- District 12**
- Pikes Peak, CO
  - Front Range, CO/WY
  - Salt Lake City, UT
  - Treasure Valley, Boise, ID
- District 13**
- Albuquerque, NM
  - El Paso, TX
  - Phoenix, AZ
  - Sun City, AZ
  - Tucson, AZ
- District 14**
- Columbia River Basin, Richland, WA
  - Portland, OR
  - Puget Sound, Seattle, WA
- District 15**
- Sacramento Valley, CA
  - San Francisco Bay Area, CA
  - San Francisco Peninsula, Palo Alto, CA
- District 16**
- Los Angeles, CA
  - Orange County, CA
  - Greater San Diego, CA
  - Southern California

# the Bent<sup>of</sup>



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by Trudy E. Bell



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by Allen D. Erickson, NM G '14, et al.



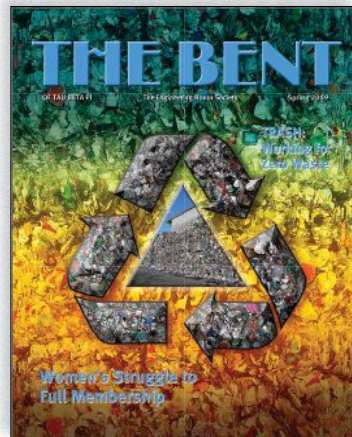
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**ON THE COVER:**  
Trudy E. Bell reviews the current and global issues affecting the recycling of refuse and reports on the role of modern materials.  
Cover artist: Dali Polivka



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The Tau Beta Pi Association

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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

## It takes real effort, every time!

Most engineers follow the engineering path. But some of them become managers, of people. It is a worthy outcome and vastly different from the world of lines, angles, and equations. Here are a few musings from my time as one, things that I often reflect on when grappling with an issue.

I became a manager of people by administrative fiat. After an organizational shakeup, I was asked to act as leader of a small team, around ten people. Being foolishly naïve I agreed, without discussion of what this meant or what was expected. I recall thinking, “Great, now I’ll set things right!” I had no training, no real aptitude for it but figured it couldn’t be too hard. So, voilà, I was a manager.

Six months later, I realized it was a lot harder than it looks. I mistakenly thought it was about telling people what to do. Wrong. That only works to the extent that you have an endless stream of effective ideas and the will to impose them. Funny thing about humans, they are often like rheopectic fluids, the harder you push them, the more resistant they become. A rare quality of fluids, but all too common in humans. We are complex, an almost infinite sum of experiences, emotions, ambitions, outcomes, failures, and successes. To recall this complexity in the moment is a challenge. *It takes real effort, every time!*

### Toughest Tasks

As a leader, it is tempting to always assign the toughest tasks to your highest performer. This can turn out badly. You may just overload them to the point of failure, and you’re letting your low performers skate. A doubly negative outcome. Sometimes good performers fail at their next assignment. Why? Because life happens. People suffer ups and downs. They marry, divorce, have children, lose loved ones, go bankrupt, fall ill, suffer an injury, become addicted, and so on. As engineers, we tend to assume consistent outcomes given the same input, but recall, humans are complex. The challenge is to really see the person, to see them in all their human frailty, and yours. *It takes real effort, every time!*

Listening is an important management skill. Listening, not hearing. This may seem counterintuitive, but the more you listen and the less you talk the more likely a positive outcome. A training module I took posits that listening has four distinct levels. They are essentially grades of empathy with the speaker. The first and lowest level is waiting for others to stop speaking so a countervailing point can be made. That is not listening at all, more like arguing. It isn’t generally productive. I have witnessed many meetings conducted in that manner and

have been guilty of such behavior myself. The fourth and highest level is an almost Zen state when the listener is so empathetic with the speaker that they understand their every motivation. Really listening is hard. *It takes real effort, every time!*

### Strongest Personalities

I met my current manager about six years ago. He is a military veteran and came to Oak Ridge National Laboratory from another Department of Energy facility. We had been operating the Spallation Neutron Source for a few years and there were many start up and power ascension issues to work through. Our division director at the time conducted a weekly open meeting where many issues were discussed; often contentious issues which tended to be dominated by the strongest personalities in the room. I recall the first meeting where my new manager attended. I closely observed him to gauge his mettle. Issues and controversies raged around the conference room, back and forth. He sat silent, saying nothing during the whole meeting. I was gravely disappointed. I thought, wow,



is this guy engaged at all? Doesn’t he have a position? Well, yes, he did. He was just being very judicious about what he said, and when he said it. We have come to know each other well, and I admire him. I don’t always agree with him and that’s ok.

### Count-to-Ten Discipline

In the ensuing years, I learned that he trained himself to never react in the moment, to exercise the proverbial count-to-ten discipline. Why? Because he understood his initial reaction is generally negative. This too is a human trait. Admit it, how often when somebody does something irksome in traffic is your initial reaction, “Bless their heart, they must be having a bad day”? For me, rarely. Ok...never. To have the discipline to suppress this initial negative reaction is hard. *It takes real effort, every time!*

In closing, let’s talk about the organization, Tau Beta

Pi. The state of TBPi is...good but not great. The Association is 134 years old. It is steeped in tradition, which can be both a blessing and a curse. It is stranded between the past and the future and is beset by competition. It is tempting to think TBPi enjoys an advantage because "Tau Beta Pi is the only engineering honor society representing the entire engineering profession." However, it is not so. There are many organizations competing for the same resources, i.e. members, volunteers, and contributions. Steady impactful change is necessary. Stopgap measures will not do. To that end the Strategic Plan was developed, and implementation begun. Initial actions have been achieved but there is much more to be done. A lot of hard work lies ahead, and tough decisions. Such is life. *It takes real effort, every time!*

Positive student experiences are the *raison d'être* of the organization. I salute all the volunteers and Headquarters staff in their efforts to achieve this objective. *It takes real effort, every time!*

**C. Craig Smith, P.E., Tennessee Epsilon '80,**  
Vice President, [csmith@tbp.org](mailto:csmith@tbp.org)

## JOIN THE EXECUTIVE COUNCIL: CANDIDATES SOUGHT

IT'S TIME to start choosing members for our Executive Council. With the recent changes to the structure of the EC in effect, the 2019 Convention will elect three members to serve the 2020-22 term. They will join the six continuing members elected in 2017 and 2018.

TBPi's current Constitution and Bylaws, particularly Const. Article X, Secs. 1- 5, delineate the nominating and electing procedures and the Council's responsibilities. More information and a position description is available at [www.tbp.org/other/ECJobDescription.pdf](http://www.tbp.org/other/ECJobDescription.pdf). Members interested in serving on the Executive Council must be nominated by a chapter—either collegiate or alumni—by April 1. The Executive Director can work with candidates needing a formal nomination.

The Executive Council is looking for members with experience in a variety of functions—management, finance, teaching, business, research, etc. Those with knowledge in the areas of image enhancement, branding, fundraising/development, alumni relations, and advising collegiate chapters are strongly encouraged to consider running.

Executive Councillors should be able to attend three to four in-person meetings each year, plus teleconferences or committee meetings each month. They should plan to attend the annual Convention, usually requiring five days including travel.

Candidates should make arrangements to attend this year's Convention in Columbus, OH, on October 10-12 where delegates will elect the new Council members.

Councillors are asked to also make several trips per year for new chapter inspections, installations, and District Conferences. They typically attend two District Conferences each year.

Individuals interested in serving on the Executive Council can receive more information from, and chapters can submit nominations to, the Executive Director via email to [tbp@tbp.org](mailto:tbp@tbp.org).

## ASSOCIATION BRIEFS

The Executive Council's first face-to-face meeting of 2019, held in Knoxville, TN, provided a good excuse for the Great Smoky Mountains Alumni Chapter (GSMAC) to host an event.

Nearly 50 Tau Bates and guests enjoyed a traditional East Tennessee BBQ buffet at Calhoun's On The River.

Attending were 15 Tennessee Alpha students; 11 GSMAC alumni including UT's Chancellor Wayne T. Davis, *TN A '73* and 2017 TBPi Distinguished Alumna Terry D. Olberding, *TN A '78*; seven members of the Executive Council, Executive Director Curt Gomulinski, Director of Alumni Affairs Tricia Gomulinski, members of HQ staff, and guests.

Several spoke after dinner including President Wayne B. Paugh; Chancellor Davis; student president, Mariah R. LaFond, *TN A '19*; and GSMAC president John A. Hopkins, *TN A '88*.



Above, from left: Sylvia and Chancellor Davis, Wayne Paugh, Curt and Tricia Gomulinski, Robert Olberding, and Harold T. Conner, *TN A '68*. Right: Students were happy to head up the buffet line!

To join an alumni chapter, contact the Director of Alumni Affairs, Tricia Gomulinski, at [tricia@tbp.org](mailto:tricia@tbp.org). Visit [www.tbp.org/Memb/Alumni](http://www.tbp.org/Memb/Alumni). *cfm* to check on local alumni events.





## WHO'S WHO

**Joseph M. Le Doux, Ph.D.,** *New York Delta '86*, is one of three educa-



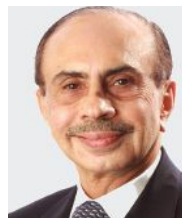
tors from Georgia Tech awarded the 2019 Bernard M. Gordon Prize for Innovation in Engineering and Technology Education. He is associate professor of biomedical engineering and an associate chair for undergraduate learning and experience at Georgia Tech. Le Doux invented the problem-solving studio approach for teaching engineering.

**Tepper L. Gill, Ph.D.,** *District of Columbia Alpha '66*, received the



2018 R.M. Santilli Foundation Scientific Award for unprecedented advances on isotopes. The award was presented at the International Conference on Pure and Applied Mathematics. Gill is an electrical engineering and computer science professor at Howard University. On his advances on isotopes, Gill commented that the whole idea of isotopes has implications for cryptology and cybersecurity.

**Adi B. Godrej, Massachusetts Beta '63**, has been awarded the ICSI's



Lifetime Achievement Award for 'translating excellence in corporate governance into reality,' by the Institute of Company Secretaries of India (ICSI). He is an industrialist and businessman, and chairman of the Godrej Group. He has also served as chair-

man of the Indian School of Business, president of the Confederation of Indian Industry, and on the dean's advisory council of the MIT Sloan School of Management.

**John R. Longenecker, Pennsylvania Beta '71**, has been named by



the Nevada Test Site Historical Foundation as its new chairman. He is president of Longenecker & Associates, Inc. and also serves as managing director of the Energy Facility Contractors Group. Longenecker has served under two presidents: as transition manager for the U.S. Enrichment Corp. under President Bush (1992) and from 1983-87 in the Reagan administration as deputy assistant secretary for Uranium Enrichment in the U.S. Department of Energy.

**Sonya T. Smith, Ph.D., Virginia Alpha '94**, is a mechanical engi-



neering professor at Howard University and has been voted president-elect of Sigma Xi, the scientific research honor society. She will be president-elect one year from next July 1, and president from July 1, 2020, to June 30, 2021. Smith joined the Howard University faculty in 1995 and is the first tenured female faculty member in the department of mechanical engineering. She works for women's leadership in STEM in both national and international initiatives.

**David J. Skorton, M.D., New York Delta '70**, has been appointed the next president and CEO of the Association of American Medical Colleges

(AAMC). He has been secretary of the Smithsonian Institution since 2015. Skorton is president emeritus of Cornell University and a board-certified cardiologist.



### Rhodes Scholars

The 2019 list of Rhodes Scholars included two Tau Bates among the 32 Americans named. Rhodes Scholarships provide all expenses for two or three years of study at the University of Oxford in England and may allow funding in some instances for four years. The Tau Bates are:

**Alaleh Azhir, Maryland Alpha '19**, is triple majoring at Johns Hop-



kins University in biomedical engineering, computer science, and applied mathematics and statistics. She will do an M.Sc. in women's and reproductive health at Oxford. Alaleh is a Goldwater Scholar, mentors middle school students, and edits a philosophy journal.

**Sarah Tress, Massachusetts Beta '19**, studies mechanical engineering



at MIT. She will pursue a M.Phil in development studies at Oxford. Tress works at the intersection of engineering and development and created Loop, a cost-effective inflatable wheelchair seat cushion, to help wheelchair users in developing countries with pressure sores.

# National Academy of Engineering

*The National Academy of Engineering has elected 86 new members and 18 foreign associates, announced NAE President C.D. (Dan) Mote Jr., Ph.D., CA A '59, in early February. Election to the academy is among the highest professional distinctions accorded to an engineer. It honors those who have made outstanding contributions to "engineering research, practice, or education, including, where appropriate, significant contributions to the engineering literature," and to the "pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering, or developing/implementing innovative approaches to engineering education." New Tau Beta Pi/NAE members are listed below.*

**Penina Axelrad**, Ph.D., MA B '85, professor, aerospace engineering sciences, University of Colorado, Boulder. For analysis of multipath GPS signals to improve satellite navigation and new approaches to remote sensing.

**Wayne S. Balta**, PA Γ '82, vice president, corporate environmental affairs and product safety, IBM Corp., Armonk, NY. For advancing corporate environmental sustainability practices worldwide.

**Gilda A. Barabino**, Ph.D., NY H '86, professor and dean, school of engineering, City College of New York, New York City. For leadership in bioengineering research and inclusive models of bioengineering education and faculty mentoring.

**Hariklia Deligianni**, Ph.D., IL A '88, retired research scientist, IBM Corp., Tenaflly, NJ. For electrochemical processes used by major microelectronic chip producers worldwide.

**Robert J. Fascetti**, MI Θ '85, retired vice president, global powertrain engineering, Ford Motor Co., Bloomfield Hills, Mich. For leadership in powertrain products with improved fuel economy, superior performance, and reduced greenhouse gas emissions.

**Alec D. Gallimore**, Ph.D., NY Γ '86, dean of engineering and professor, University of Michigan, Ann Arbor. For advanced spacecraft electric propulsion, especially Hall thruster technology.

**Sharon C. Glotzer**, Ph.D., MI Γ '87, department chair of chemical engineering and professor, University of Michigan, Ann Arbor. For development of computer-based design principles in assembly engineering and manufacturing of advanced materials and nanotechnology.

**Linda P. Hudson**, FL A '72, chairman and chief executive officer, The Cardea Group, Charlotte, NC. For leadership in development and production of military systems, and for mentoring and developing future engineering leaders.

**Behrokh Khoshnevis**, Ph.D., OH Δ '79, president and chief executive officer, Contour Crafting Corp., El Segundo, Calif. For innovations in manufacturing and construction, including the application of 3D printing methods.

**Robert D. Kiss**, Ph.D., CA A '85, vice president, process and analytical development,

Sutro Biopharma Inc., South San Francisco. For contributions to mammalian cell culture and microbial processes that produce recombinant proteins and antibodies.

**John H. Koon**, Ph.D., TN B '67, president, John H. Koon & Associates, Atlanta. For contributions to the design of systems to treat chemically complex industrial wastewaters.

**Charles J. Kuehmann**, Ph.D., AZ B '88, vice president of materials engineering, SpaceX and Tesla Motors, Palo Alto, CA. For contributions to the creation and commercialization of computational materials design.

**Jefferson C. Lievens**, Ph.D., MI Γ '76, senior adviser to the chief executive officer, bioengineering and technology, Genomatica Inc., San Diego, CA. For leadership in biomanufacturing of sustainable chemicals.

**Kathryn A. McCarthy**, Ph.D., AZ A '83, vice president, research and development, Canadian Nuclear Laboratories, Chalk River, Ontario, Canada. For leadership in research and data analysis in support of licensing extensions for light water nuclear reactors.

**Laura J. McGill**, WA A '85, vice president, engineering, Raytheon Missile Systems, Tucson, AZ. For technical leadership of missile systems for the United States and its allies.

**Rosalind W. Picard**, Sc.D., GA A '84, professor and director of affective computing research, Media Lab, Massachusetts Institute of Technology, Cambridge. For contributions to affective and wearable computing.

**Darryll J. Pines**, Ph.D., MD B '86, professor and dean, school of engineering, University of Maryland, College Park. For inspirational leadership and contributions to engineering education excellence in the United States.

**A. Miguel San Martin**, NY B '82, chief engineer, guidance, navigation, and control, Jet Propulsion Laboratory, Pasadena, CA. For technical contributions and leadership in guidance, navigation, and control leading to successful Mars entry, descent, and landing.

**Christopher A. Schuh**, Ph.D., IL A '97, department head and professor, materials science and engineering, Massachusetts

Institute of Technology, Cambridge. For contributions to design science and application of nanocrystalline metals.

**Sheldon L. Semiatin**, Ph.D., MD A '71, senior scientist, materials/processing science and research leader, Metals Processing Group, Air Force Research Laboratory, Wright-Patterson Air Force Base, OH. For contributions to thermomechanical processing of aerospace alloys and emerging intermetallic materials.

**Jane McKee Smith**, Ph.D., SD B '83, senior research scientist for hydrodynamic phenomena, engineering research and development center, U.S. Army Corps of Engineers, Vicksburg, Miss. For leadership in coastal engineering research and development resulting in improved infrastructure resilience.

**John G. Speer**, Ph.D., PA A '80, distinguished professor and director, advanced steel processing and products research center, Colorado School of Mines, Golden. For the conception, invention, and reduction to practice of quenching and partitioning steel.

**Kay M. Stanney**, Ph.D., NY N '86, president and founder, Design Interactive Inc., Orlando, FL. For contributions to human factors engineering through virtual reality technology and strategic leadership.

**Hemant K. Thapar**, Ph.D., CA Z '73, chairman and chief executive officer, OmniTier Inc., Milpitas, CA. For contributions to theory and practice of coding and signal processing for high-density magnetic recording.

**Jean W. Tom**, Ph.D., MA B '84, group director, process research and development, Bristol-Myers Squibb, New Brunswick, NJ. For leadership in the process development of multiple commercialized drugs.

**Christine A. Wang**, Ph.D., MA B '77, senior staff scientist, laser technology and applications group, MIT Lincoln Laboratory, Lexington, MA. For contributions to epitaxial crystal growth of III-V compound semiconductors and design of organometallic vapor-phase epitaxy reactors.

**Aart J. de Geus**, Ph.D., TX I '83, chairman and co-chief executive officer, Synopsys Inc., Mountain View, CA. For leadership and technical contributions to logic synthesis for integrated circuits.

# Trashed! Engineering Towards Zero Waste

China will no longer accept most U.S. household recyclables. Other nations won't, either. The U.S. does not mill most recyclables. So, many bottles, cans, paper, and plastics are ending up in landfills...

By **Trudy E. Bell** ©2019 Trudy E. Bell

**N**ATIONAL SWORD—that is what China named its policy. In July 2017, China notified the World Trade Organization that effective January 1, 2018, it would ban imports of 24 materials, including post-consumer plastic and mixed paper. In November 2017, China further announced that effective March 1, 2018, it would impose a new quality standard for all allowed paper, paperboard, and metals. It would accept only shipments of recyclables that were 99.5% pure—only 0.5% of impurities would be permitted.

National Sword hit two weaknesses in the U.S. recycling industry that most Americans didn't know existed. First, most U.S. materials-recovery facilities or MRFs (rhymes with “Smurf”)—which sort recyclables—are “single-stream” systems, and a purity standard of 99.5% is unattainable. Second, most U.S. mixed paper and newsprint plus certain plastics (numbers 3 through 7) are not milled—melted or otherwise processed—here at home into feedstock raw materials for making new products. Few such domestic mills exist. Instead, most U.S. recyclables were separated, crushed, baled, and loaded onto container ships headed across the ocean.

## Industry Reeling

China's announcements—intended to improve its air quality and reduce pollution—sent the worldwide recycling industry reeling. In 2016, that country alone consumed more than half of the world's recycled paper and plastic. Indeed, China had been the largest consumer of U.S. recyclables for years. In 2016, the

U.S. exported some 41% of paper, much of it going to Chinese mills. Nor is it alone: some years, the European Union exported 95% of its plastics to China.<sup>8,18</sup>

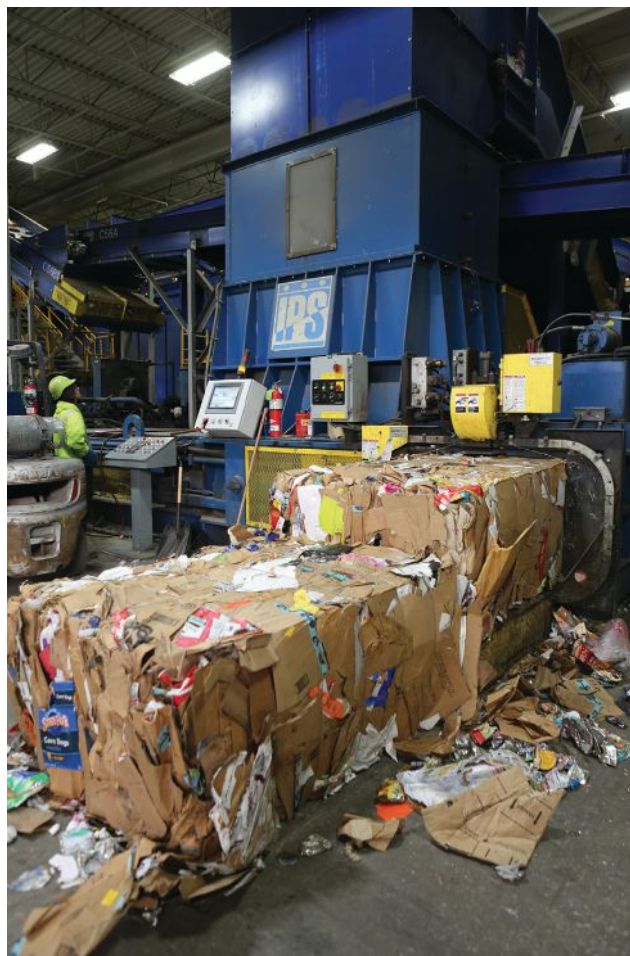
The immediate response was to reroute shipments to other Asian nations, such as Cambodia, Malaysia, Taiwan, and Vietnam. But by the end of 2018, those nations also rebelled. Like China, they welcomed recyclables clean and pure enough to be milled into useful feedstocks, but not what in some cases seemed little better than garbage. Meantime, China cracked down on illegal smuggling of the banned materials past its borders, scanning containers with X-ray machines and opening containers that could not be scanned,<sup>9</sup> and mandating pre-shipment inspections before recyclables left an exporting nation's port. Additional stringent regulations have been rolled out for 2019.<sup>7</sup>

## Great Idea

At first, a few decades ago, exporting U.S. recyclables to China seemed like a great idea...

By the first Earth Day in April 1970, a dedicated core of true believers realized that when you throw something away, there is really no “away.” Discards had to go somewhere, sometimes to an incinerator but most often to a dump (now called a landfill). To be sure, used clothes could be donated to thrift shops, old cars could go to junkyards, and glass beer

and soft drink bottles could be returned for deposits and refilled. However, by 1970, beverage distributors were phasing out bottle washing as they continued shifting from heavy glass to lightweight, one-way glass bottles, marked



This machine at a Republic Services materials-recovery facility (MRF) compresses bales of all commodities (except glass) for shipping. Each bale of cardboard weighs around 1500 pounds. Photo: Trudy E. Bell.

RIGHT: Single-stream recycling only requires that recyclables be separated from other garbage such as clamshell takeout containers, which most MRFs cannot process. Photo: NOAA. BELOW: Multi-stream recycling means people must separate materials into different bins. Photo: Trudy E. Bell.

“No Deposit, No Return, Not To Be Refilled.” As beverage distribution moved from local bottling plants to regional or national distribution facilities, bottlers light-weighted their containers even more by switching to aluminum cans and plastic bottles.

But glass, like steel and aluminum cans, could be melted down and reformed into containers or other products, just as uncoated paper could be pulped and used for paper or box-board. Why not give such materials second life rather than a one-way trip from mine or tree to landfill?

### Early Recycling

Early household recycling required consumer commitment. By the 1980s, depending on the municipality and its waste-management company, households could be required to wash food cans, remove the paper labels, and crush the cans with the sharp-edged lids inside; separate glass bottles by color (clear, green, and brown) and plastic bottles by number; and tie newspapers into bundles. Each type of item had to be placed out on the curb in a separate open bin or box (no plastic bags), which were emptied by collectors into multiple-compartment recycling trucks.

This system—called either source-separated or multiple-stream—results in the cleanest recyclables ready for milling. However, there were objections. Some municipalities found the specialized trucks and manpower needs expensive. And too many consumers found the elaborate sorting burdensome, so they refused to comply, sneaking recyclables into ordinary garbage headed for the landfill.

The high cost and low compliance not only slowed the universal adoption of recycling across the nation. They also lowered the calculated return on the projected cost of building mills to process recyclables into feedstocks for creating new products, discouraging capital investment.

### Perfect Solution

The 1990s brought two independent developments whose combination seemed to offer a perfect solution.

Consumers would recycle, it seemed, only if recycling could be made as simple and convenient as the act of tossing something into the trash. But simplifying the process at the consumer end monumentally complicates separation at the recycler’s end.

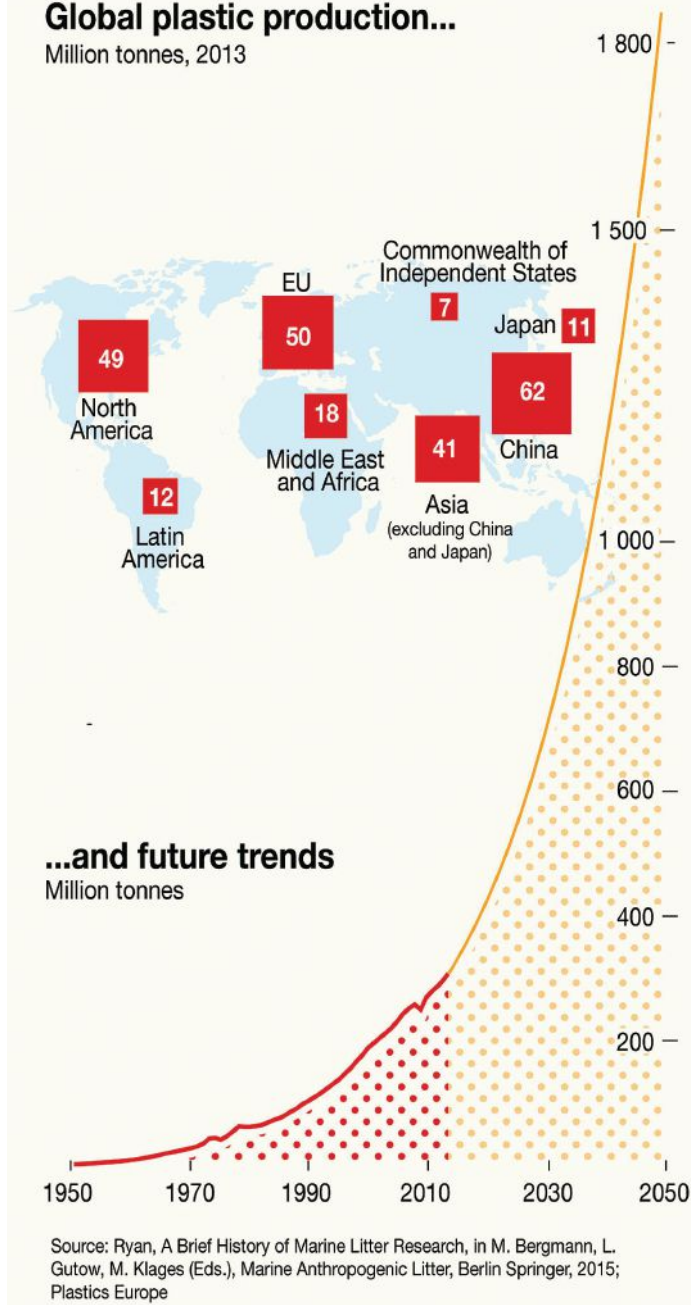


The breakthrough was the development of multimillion-dollar separation equipment that today can stand up to four stories high and occupy 50,000 to 200,000 square feet. Agitating screens separate cardboard from other paper, glass, and debris. Drum magnets select out steel cans from a conveyor belt, while rare earth magnets—which induce eddy currents in non-ferrous metals—repel aluminum cans over a barrier to another conveyor belt. As plastics speed by, high-resolution near-infrared optical sensors determine their composition, activating air jets that separate bottles by type.

These high-tech behemoths enabled single-stream recycling: garbage separated from recyclables, but all recycla-

## Global plastic production...

Million tonnes, 2013



Single-use disposable applications (such as food packaging) account for about a third of plastics produced worldwide—but account for some 60% of plastics found in waste streams.<sup>14</sup> Credit: Maphoto/Riccardo Pravettoni.

China liked the idea, because some recyclables (notably steel, plastics, and mixed paper) were cheaper raw materials than refining from ore, crude oil, or trees—enough to allow China to pay some U.S. MRFs from \$100 to \$1,000 per ton for bales, depending on the material and the market conditions. U.S. recyclers liked it, because it not only deferred the need for capital investment to build mills at home but also generated income.

From 1980 to 2015, though, the amount of U.S. municipal solid waste increased by 73%.<sup>21</sup> Moreover, it became overwhelmed by plastics, most of which do not biodegrade. Virtually all the plastics ever made have been manufactured just since 1950.<sup>15</sup> According to the United Nations, at the present growth rate of plastics production, the industry worldwide is on track to “account for 20% of the world’s total oil consumption” by 2050.<sup>25</sup>

Simultaneously, single-stream recycling is becoming a victim of its own success. Although well-intentioned consumers vaguely know that not all plastics are recyclable, they practice what the recycling industry curses as “wish-cycling”—throw all plastics into the recycling bin and “let them sort it out.” Problem is, manufacturers’ introduction of new plastics and plastic products outstrips the pace of the recycling industry’s ability to handle them.

### Industry Headache

Quick plastics 101: Plastics are based on many different petrochemical resins, with the six most common indicated by the number 1 through 6 inside a triangle stamped on a product, while 7 is used for all other resins and combinations. Most municipalities recycle beverage and detergent bottles and jugs made of No. 1 (PETE or polyethylene terephthalate, also called PET<sup>®</sup>) or No. 2 (HDPE or high-density polyethylene). Many will not accept items made of plastics 3 through 7, whose composition can also include a wide range of chemical additives (e.g., flame retardants, pigments, plasticizers, stabilizers).

Contamination is a major industry headache: ranging from liquid residues in unrinsed containers to what-were-they-thinking non-recyclables (“We’ve had garden hoses, plastic kiddie swimming pools, hypodermic needles, even full propane tanks and live shotgun shells,” said Dan Schoewe, operations manager of the Republic Services MRF in Oberlin, Ohio). But by volume, the worst contamination comes from the wrong kinds of containers. For example, to-go coffee cups, juice boxes, flexible pouches, and K-cups include metal foil, paper, or more than one type of plastic, which cannot be separated.

As manufacturers introduced more products with non-recyclable plastics at the same time cities and counties were adopting single-stream recycling, contamination levels in bales increased. Most single-stream MRFs today produce bales that are 97% free of contaminants such as foam cups and food waste: a ton of mixed paper, for example, might include 3% or 60 pounds of plastics or other materials. But plastics are so lightweight that such a contamination level could result in a volume of plastics too great for a paper mill to handle. Plastic films or sticky labels that get into the hydropulper are likely to clog the parts of the

bles combined in one bin. Single-stream was easy-peasy for consumers, and more began recycling. It was also cheaper for municipalities, which could use the same single-compartment trucks for both recycling and garbage on separate runs. Ultimately, when combined with standard 90-gallon wheeled carts, single-stream enabled automated curbside pickup, reducing manpower to a single driver operating a truck’s robotic arms.

### Manufacturing Powerhouse

Meantime, China was becoming a manufacturing powerhouse. But container ships that brought “Made in China” imports were dead-heading empty back to China for the next shipment—a total waste of capacity. Why not instead fill them with recyclables that China could mill at lower labor costs to create feedstocks for manufacturing new products, both for its own fast-growing domestic market as well as for export?

RIGHT: Bales of plastics 3 through 7, no longer accepted as shipments to China, being stored outside a Republic Services MRF in Ohio, waiting for another market to develop. BELOW: Conveyor belt sorters remove thin, flexible items such as drinking straws and grocery bags so they do not tangle and foul an MRF's single-stream separation machinery. Photos: Trudy E. Bell.

machine on which paper or paperboard is formed. So China balked.

But wait, there's more.

The fastest-growing category of municipal solid waste (3 to 5% per year) is electrical and electronic waste: anything with a battery or plug.<sup>10</sup> Such e-waste ranges from large appliances (like refrigerators, washing machines, air conditioners), photovoltaic panels, and medical equipment to personal computers and mobile or wearable devices.

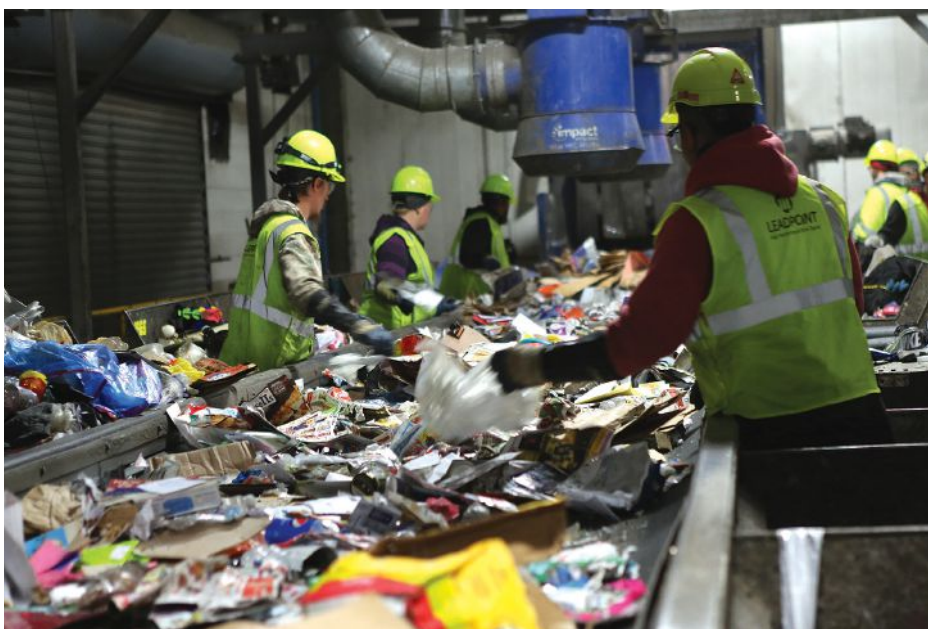
In 2016, 44.7 million metric tons of e-waste was generated globally; discarded mobile phones alone amounted to 435,000 metric tons—20% more mass than the Empire State Building. Yet, less than a fifth of e-waste was recycled.<sup>4,12</sup> E-waste is increasing every year, because electronics have a finite and ever-shortening lifetime: anymore, five years is long for a desktop computer, and many smartphones are replaced every year or two.

### Technical Challenge

Recycling e-waste is a technical challenge; a single printed circuit board can incorporate more than a third of the periodic table, including precious metals (e.g., gold, silver, platinum, palladium) and other high-value metals at concentrations higher than in mineral ores. E-waste includes rare earths (in magnets, speakers, vibrators, hard drives)—elements the Department of Energy has classified as critical to national energy security.<sup>11</sup> Additional elements (e.g., cobalt, lithium, yttrium) appear on the Defense Logistics Agency's list of materials of strategic importance.<sup>27</sup>

Although backyard recyclers in Asia use acid baths to recover gold, silver, palladium, and copper,<sup>26</sup> comparatively little industry attention has been devoted toward reclaiming useful substances from printed circuit boards. Long-term, the rate at which valuable materials are discarded in e-waste raises questions of depleting reserves of materials of military significance or economic sustainability. Given that most of the world's cobalt comes from the Democratic Republic of Congo, for example, *The Economist* recently asked: "Can the world produce enough cobalt for electric vehicles?"<sup>26</sup>

Existing consumer economy is linear: resources are extracted from the ground, manufactured into products, used by consumers, and—too often after just a single use—are discarded as waste. Although the literature differs widely in calculating recycling recovery rates from U.S. residential municipal solid waste, all are dismal, ranging from 23% to as low as 12% (percentages are significantly



higher for institutional, commercial, and industrial scrap and waste, but percentages for most materials are still under half).<sup>20,24,19</sup>

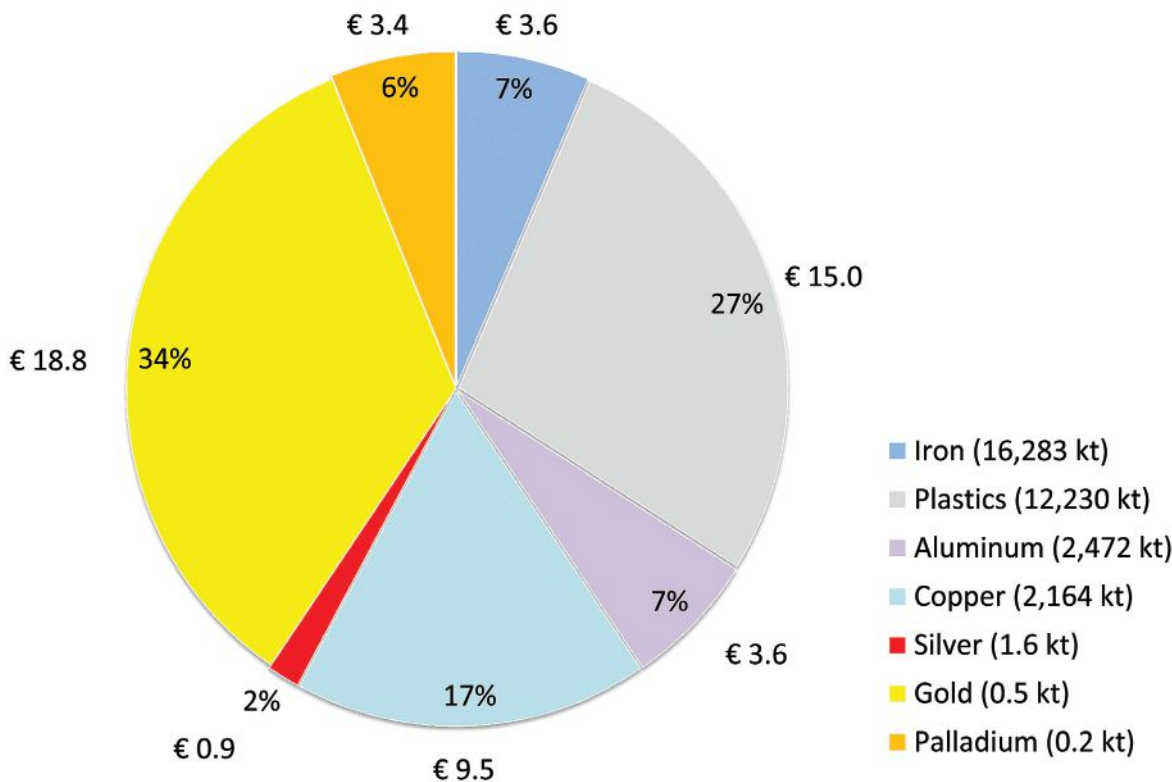
Discarding more than three-quarters of plastics and e-waste—or anything else—is a colossal waste of resources. It is also a loss of big money: e-waste alone in 2016 was estimated at 55 billion euros worldwide—more than the 2016 GDP of most nations. This landfilled e-waste included some 18.8 billion euros (over \$20 billion) in gold!<sup>4</sup>

### Reduce Future Waste

"Recycling delays, rather than avoids, final disposal," noted one analysis.<sup>15</sup> "It reduces future plastic waste generation only if it displaces primary plastic production," that is, production from virgin stock—petrochemicals in the case of most plastics, but also mineral ores or trees for other materials. Therefore, an increasing number of voices are calling for full-scale re-envisioning of the entire economy—moving from a linear economy to a circular economy.

An authentic circular economy would minimize the extraction of virgin resources from the ground by maximizing the reuse of resources already extracted. In a perfect

## Estimated Value of Materials in E-Waste Generated in 2016 (Billion €)



Less than 20% of e-waste was recycled in 2016. Some 80% was likely landfilled—including about 2 tons of gold and precious metals. Credit: The Global E-waste Monitor 2017<sup>4</sup> and Trudy E. Bell.

brewery in the country.<sup>22</sup>

Such steps are a microcosm of many efforts worldwide. In late 2018, the European Union voted to ban single-use plastics by 2021, augmented by a multitude of initiatives in nations and corporations around the world.<sup>16</sup>

Enabling a circular economy will require more than policy. The practical nuts and bolts of designing prod-

ucts and implementing processes and infrastructure will fall largely to engineers.

Product design for a circular economy means engineering to *prevent* waste—not only on the factory floor, but also through a lifetime of use and eventual disposal. It means prioritizing not only designing for manufacturability, but also designing for durability (to lengthen life), reparability (to maintain useful life), and recyclability (for the disassembly and recovery of materials at the end of life). It also means rethinking product packaging—for example, designing compostable packaging that could return nutrients to soil, or employing reusable containers instead of single-use corrugated boxes for business-to-business shipping.<sup>13</sup>

Another need is reducing the use of plastics throughout the entire value chain. That would mean rethinking the housings of products, returning perhaps to steel or aluminum (which can be infinitely recycled) instead of plastics (which cannot).

### Refillable Bottles

To the degree no other material will do, a circular economy means using or formulating more plastics that can be infinitely recycled, or exploring where and how plastic products can be reused in the economy in a way analogous to reusing glass bottles—with an ultimate goal of relying on renewably sourced feedstocks and decoupling plastics from fossil-fuel feedstocks.<sup>13</sup>

Parts of the beverage industry are leading the way to a circular economy by returning to refillable glass bottles. A single sturdy glass beverage bottle can be refilled 10 to 30 times before it chips or cracks. A refillable bottle that makes 25 trips consumes 93% less energy than a single-use disposable bottle.<sup>28</sup> At least 40 dairies around the U.S. and Canada have used refillable glass bottles for years,<sup>1</sup> and now some craft breweries and wineries are doing the same.<sup>2</sup> In September 2018, seven craft breweries led Oregon to launch the nation's first statewide refillable bottle program, developing a bottle that can be used by any

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### Entire Value Chain

A circular economy for e-waste would entail processes for reclaiming high-value metals, strategic materials, and toxins and for reuse and/or safety. The list goes on...

Initially, many in the recycling industry decried China's National Sword policy as 'the end of recycling as we know it.' MRFs now must pay to have bales removed rather than receiving income for them. "It is the end of cheap and low quality recycling," declared Antonis Mavropoulos,

Discarded cellphones await their fate at an informal e-waste recycling site in Ghana. Gold accounts for nearly 70% of the value of materials in obsolete or broken cell phones.<sup>11</sup> Photo: Fairphone.



president of International Solid Waste Association (ISWA). “This (ban) will accelerate the collapse of a business model that is efficient in terms of money but not effective in terms of pollution.”<sup>23</sup>

But National Sword also spells opportunities for the recycling industry: in the short term, for example, to pioneer advances in sensor-based technologies to vastly decrease contamination and improve the purity levels of single-stream recycling.

More importantly, it is spurring people industry-wide to think longer term about overhauling our disposable linear economy. “We need to start paying attention and fix this,” stated Michael Durfor, executive director of Northeast Resource Recovery Association. “Don’t make materials we have to throw away; don’t make materials that can’t be reused. The hierarchy is: reduce it first, then reuse it, then recycle it. We [recyclers] are the last line of defense.”<sup>25</sup>

The author wishes to express gratitude to the following individuals for information, illustrations, and review: Thorsten Geuer, Bayern Brewing, Inc.; Karen Hilsberg, Container Recycling Institute; Skip Lacaze, Californians Against Waste; Caren McNamara, Conscious Container; Cassandra Profita and Ann Suckow, Oregon Public Broadcasting; Joel Schoening, Oregon Beverage Recycling Cooperative; and especially to Dan Schoewe, Republic Services, for hosting my photo shoot at the Oberlin, Ohio, MRF.

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Where URLs are not specified, most references can be found online by searching on the title.

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**TRUDY E. BELL, M.A.** ([t.e.bell@ieee.org](mailto:t.e.bell@ieee.org)), former editor



for *Scientific American* and *IEEE Spectrum* magazines and former senior writer for the University of California High-Performance AstroComputing Center, is author or co-author of a dozen books and 500+ articles. This is her 29<sup>th</sup> feature for *The Bent*. She is standing next to bales of plastics 3 through 7 that are stacked outside the Republic MRF in Oberlin, OH, waiting for a market to develop. Photo: Dan Schoewe.

This is the second of three articles to mark the 50th anniversary of women being initiated in the Association. The third will be in the Summer Bent.

# THE STRUGGLE: Women's Badge to Full Membership

by Allen D. Erickson, *New Mexico Gamma '14*, with assistance from Ashley L. Begley, *Colorado Alpha '10*; Sue L.R. Holl, *California Lambda '76*; and Josuan Hilerio-Sanchez, *Puerto Rico Alpha '07*.

**T**HE EARLIEST WE KNOW that Tau Beta Pi could have initiated a woman into membership was in 1903 when the Executive Council rejected Illinois Alpha's attempt to initiate Ethel Ricker, an eligible architectural student. The matter was brought before the 1903 Convention, where the delegates affirmed the Council's decision and resolved to interpret the Constitution as restricting membership to men. It took decades and numerous attempts by subsequent Conventions to undo that choice.

To allow women into the Constitution, a number of amendments had to be made changing gender references ("men" to "students," etc.) in order for the prohibition on membership for women to be erased. The usual first step in the amendment process for TBPI has been a motion at Convention for which at least 75% of the voting delegates present must vote in favor.

While the topic had been considered at several previous Conventions, it wasn't until the 1938 one—the same gathering at which the Women's Badge program was announced, giving chapters an option to recognize outstanding female engineering students—that opening membership to women was allowed an actual vote since 1903. Only one delegate voted in favor of full membership for women, but it signaled the beginning of a long fight.

## REPLACED MEN DURING WAR

When the United States joined World War II in 1941, Convention had to be canceled as a large number of Tau Bates were drafted into the military. At the same time, women became more and more active in technical fields, particularly manufacturing, as they replaced men joining the armed forces. Beginning with the Convention of 1946, the first since the end of the war, admission of women was considered nearly every single year.

Between 1946 and 1952, six attempts were voted down, although twice a majority of delegates supported the attempt. They did not reach the required 75%, however. The main arguments for and against the amendments were fleshed out during this time and changed very little for the next decade.

In the 1950s, two primary reasons for excluding

women were given. First, many Tau Bates felt that admitting women would destroy the "fraternal spirit" of the organization. Second, surveys had indicated that women who studied engineering often did not remain in the engineering profession long after graduation.

This argument had three main faults: it was based on limited statistics (as an example, a survey that included only three women who had graduated at least 10 years earlier), it didn't consider that women had fewer job opportunities in engineering due to discrimination, and it was hypocritical, as there was no requirement for Tau Bates to remain in engineering and plenty of men had also left the field.

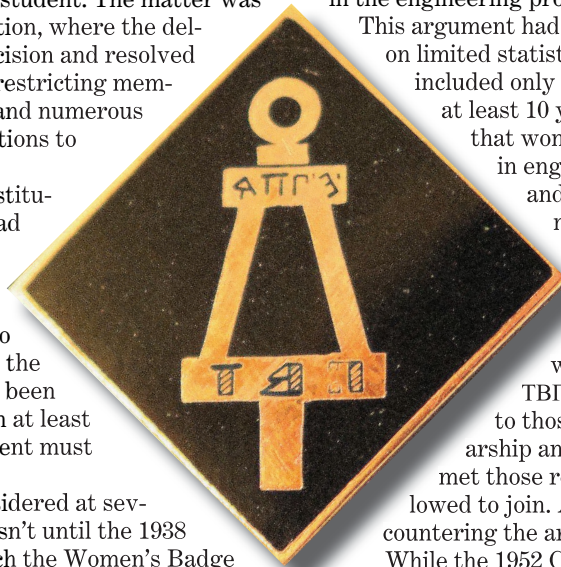
Arguments for admitting women focused on one concept—TBPI should only restrict membership to those who have "distinguished scholarship and exemplary character"; if women met those requirements, they should be allowed to join. Additional arguments focused on countering the arguments against inclusion.

While the 1952 Convention was unsuccessful in passing the necessary amendments, delegates tasked Secretary-Treasurer R.H. Nagel, *New York Delta 1939*, with asking existing recipients of the Women's Badge for their perspectives. The following year, a survey was sent to 150 recipients.

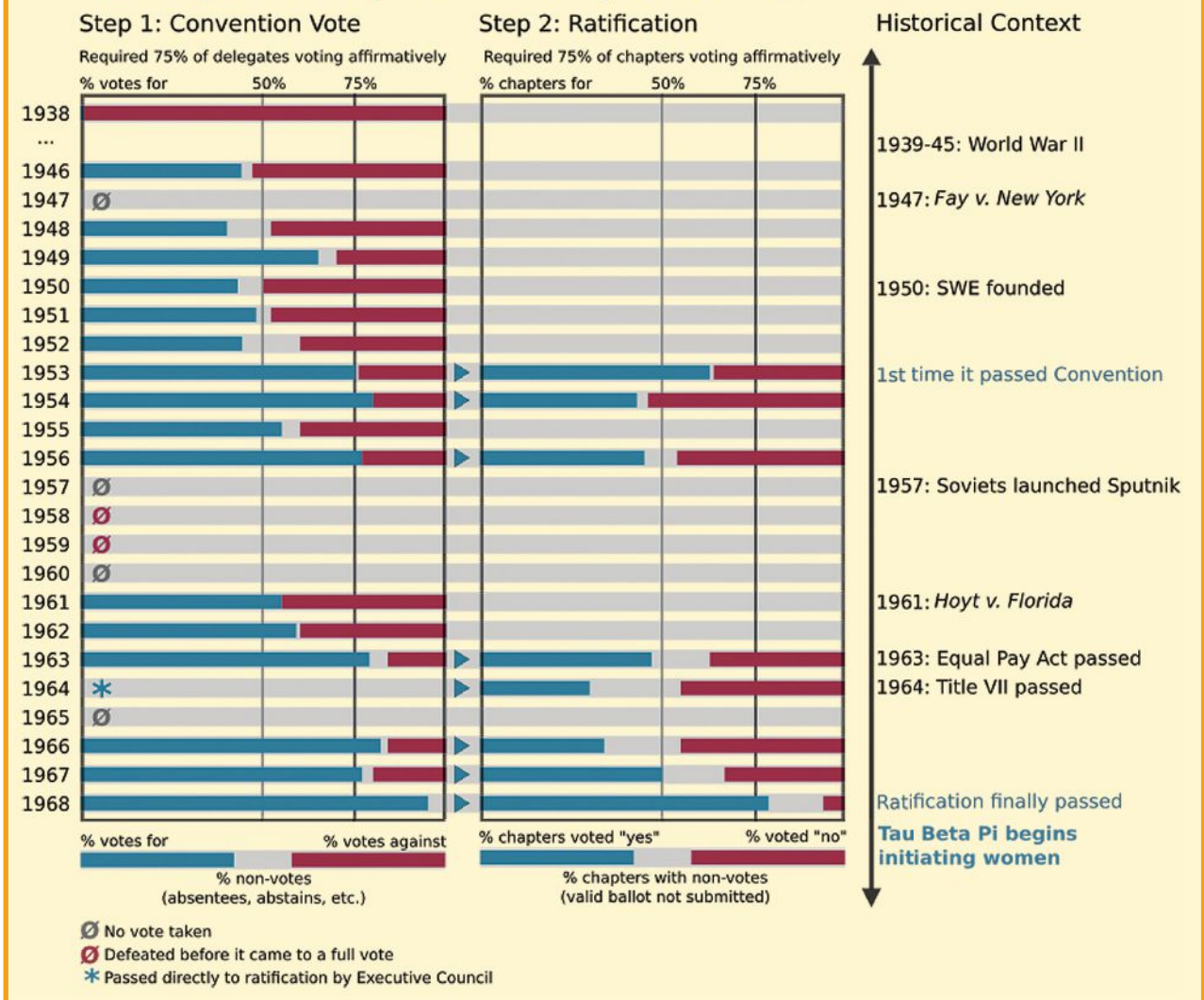
Some 86 of them responded, and a clear majority indicated they felt women should be allowed to join. Gloria Asch Hackel, *New York Eta 1945*, stated in her response, "I have always felt that to make a distinction on the basis of sex was unworthy of an organization such as Tau Beta Pi. When the object of a group such as this is to reward intelligence and diligent application, to discriminate in the fashion, seems uncalled for." Several recipients also wished they had full membership as it would have helped in the struggle to get a job as a female engineer.

The year 1953 marked the first time the amendments intended to open membership to women passed the Convention floor, with exactly 75% of the present active members voting in favor of admitting them. Then the amendments were sent to the chapters for ratification.

This process is simple. Each chapter meets to vote on the amendments. A quorum of active members must be present, and 75% of those at the meeting vote in favor for



# Twenty Attempts in Thirty-One Years



the chapter's vote for ratification to be "yes." If less than three-quarters support the changes—even if a majority still vote for them—the chapter decides against.

Although a clear majority (69%) of all voting members in 1953 voted for inclusion during the attempt at ratification, the specific requirements were not met. Only 63% of chapters reached the three-fourths affirmative vote. And 1954 saw almost identical results. Again in 1956, Convention passed the amendments, but the chapters failed to ratify them. In all three cases, the majority of students voting during ratification voted in favor of the changes, but not enough chapters achieved the necessary three-fourths affirmative vote. The requirements may seem strict, but several other amendments, mostly administrative matters, passed easily during this time.

## LITTLE SUCCESS AT CONVENTION

Following these three failures to ratify the changes, the amendments faced little success at Convention over the next four years. Twice no vote was taken at all, and twice the vote failed before it even got to a full roll call vote. TBPI wasn't alone in feeling a reverse of the progress that had been made in supporting gender equality. In the area of allowing women to serve on juries, for example, the U.S. Supreme Court had ruled in *Fay v. New York* (1947) that women were equally qualified to do so, but

that progress was somewhat diminished when the Court in *Hoyt v. Florida* (1961) upheld a Florida statute that implicitly discriminated against women in jury selection.

At the same time, more and more women were becoming involved in engineering and science. As a response to the Soviets' launch of Sputnik in 1957, the U.S. Government began campaigning to get both sexes to study science and technology. A survey released in 1964 by the Society of Women Engineers (SWE) showed that 53% of female engineering graduates stayed in the profession. Notable contributions were being made by women.

These facts directly countered the common narrative of Tau Bates against inclusion who had claimed that women didn't remain engineers. Slowly, those arguments disappeared, and even those against inclusion admitted they had a presence in engineering, a presence that wasn't going away.

Full votes on the topic began again in 1961. The next year, two Women's Badge recipients—Maryly Van Leer Peck, *Badge #102 then Tennessee Beta 1951*, and Judith C. Siegel, *Badge #222*, attended Convention and spoke in favor of full membership. The year 1963 marked the first time since 1956 that the amendments made it out of Convention, only to suffer a similar fate during ratification as those in the 1950s.

In an attempt to reduce the amount of time spent on

the topic at Convention, the Executive Council of 1964 used another mechanism for the amendments; they used their constitutional powers to directly submit proposed changes to the chapters for ratification. This marked a significant change in the EC's stance; after all, it was the Council who first decided to exclude women, rejecting Ethel Ricker's election in 1903. Ratification still failed.

The Convention of 1965 chose not to vote on the subject, as two attempts in a row had failed. The years 1966 and 1967 both saw the amendments pass Convention floor but fail ratification in the same way as before: a majority of active chapter members voted for, but not enough chapters reached the three-fourths majority needed to approve the amendments.

### NEED WAS URGENT

By this point, only one primary argument from the opposition remained: "tradition." A minority report from the Constitution & Bylaws Committee from 1966 stated, "The unspoken unity of mind and spirit present in existing chapters would be shaken if not destroyed. Standing procedures and functions, regardless of worth, would have to be changed." The opposition also feared the Association would never be able to turn back once they admitted women.

While opposing arguments diminished, new reasons for opening membership surfaced. Some alumni refused to support TBI until the exclusion was lifted. Female students eligible for the Women's Badge rejected it, preferring no recognition over inferior recognition. State laws against sex discrimination began to threaten some chapters at state universities who faced losing recognition from their university due to the exclusion.

The need to finally pass the amendments for allow-

ing women was urgent. When G. Ronald Ames, *Maryland Beta 1969*, was elected chair of the Constitution & Bylaws Committee at the 1968 Convention, Secretary-Treasurer Nagel took him aside after the first meeting and spoke with him for hours about each and every argument that he had heard over the years for and against the amendments. Nagel was "desperate to get it passed," according to Ames.

Realizing the vast majority of the committee saw no controversy about admitting women, they set about a vigorous strategy to make sure it passed Convention: a groundswell. Committee members spread out to talk to every other voting delegate at Convention in order to convince them all to support the amendments. The result was significant—not one voted against.

Perhaps partly as a result of convincing every present voting delegate—most of whom were the chapter presidents who presented the amendments to their members—the ratification process finally saw a different outcome: 79% of the chapters achieved the needed three-fourths majority, and the amendments were finally ratified. In the Spring of 1969, 155 women were initiated as members, 97 of whom had held the Women's Badge.

Despite the significance, the moment was not fully celebrated, not because of disagreement with the result but because of how long it took. Secretary-Treasurer Nagel, who had first written in *The Bent* of his support for full membership for women in 1952, wrote in the Summer 1969 issue, "And thus is a chapter in the history of Tau Beta Pi brought to a close, a bit late, but successfully.

'The Women Question' [as the subject was commonly referred to] is no more. May it rest in peace. In recent years it was not one of the Association's prouder aspects."

## ENVIRONMENTAL ENGINEER & PIONEER

**MARJORIE A. FRANKLIN (1935-2011)**, Badge #202 and later Kansas Alpha '57, was the first woman to enroll in and graduate with a degree in aerospace engineering from the University of Kansas (KU). In 1954 as a junior at KU, she became the first woman member of the Sigma Tau Fraternity, which merged with Tau Beta Pi in 1974. As an undergraduate, she served as editor of the *Kansas Engineer* and secretary-treasurer of the Institute of Aeronautical Sciences, among other campus activities.

She applied her engineering education and writing experience to the field of municipal solid waste, for which she was internationally known. Her professional career included 20+ years as an environmental engineer of management responsibility for development of the material flows methodology for characterizing waste used in reports published annually by the Environmental Protection Agency (EPA). A sample of her research/writing can be found in chapter 5 (Solid Waste Stream Characteristics) of the *Handbook of Solid Waste Management*, Second Edition.

In 1983, she became president of Franklin Associates, an environmental consulting firm, and during this time she was also active in the solid waste processing division of the American Society of Mechanical Engineers (ASME). She was the first woman to chair that division. She later became principal engi-



neer and co-owner of Franklin Associates with her husband.

In her personal life, she married William E. Franklin and had two children (Mark and Janice). William co-founded Franklin Associates, later served as mayor of Prairie Village, KS, and passed away in 2016.

In addition to her family and career, Marjorie was heavily involved with her alma mater spending more than 17 years as an active member of the School of Engineering Advisory Board. Again leading the way as the first female on the board and the first to chair the board. In 2003, she was the recipient of the KU Distinguished Engineering Service Award in part due to advocating and encouraging other women to pursue a career in engineering.

Marjorie was the fifth Women's Badge recipient from the Kansas Alpha Chapter in 1956 and was initiated as a member of Tau Beta Pi in 1969. She is remembered for her lifelong dedication to engineering, technical writing abilities, leadership in professional societies, and commitment to the University of Kansas. As a pioneering Jayhawker, she paved the way for future generations of engineers.

—Dylan S. Lane, HQ Communications Specialist

## ENGINEERING WAS HER REBELLION

**ELEANOR KUSHEL BAUM**, Ph.D., *Badge #249 and later New York Eta '59*, immigrated with her parents through Canada to the United States after World War II. She attended public school in New York City.

In those days, women were bound to be a school teacher or a nurse and perhaps graduate with an MRS degree. You worked until you married, stayed home to raise children, and then went back to teaching. The guys in her high school wanted to be engineers. She didn't really know what they were, but she tried it out as her mother wanted her to be a high school math teacher. She finally said "No, I'm not. I'm going to be an engineer." Her mother gasped and said, "You can't do that. People will think you're weird, and no one will marry you." Becoming an engineer was her rebellion.

Eleanor studied electrical engineering at City College of New York. She got good grades and had a lot of friends, all male. She was admitted to Eta Kappa Nu, the electrical engineering honor society, which did accept women. Eleanor also qualified to join TBII and had to write an essay. She wrote about volunteering at a children's ward in the local hospital, which the men thought was really weird, strange, and non-technical, but it was clear she was different from them. She received the Tau Beta Pi Women's Badge in 1958. She was asked to step out of the room before the initiation ceremony and came back for the party afterward. She received an orchid, which she thought was nice. A lot of her friends were being initiated, so it was an honor to be included.

Eleanor graduated in four years as the only woman in her class. She took a job in aerospace on Long Island but hated it and started looking for other options. She was offered a National Defense fellowship which paid tuition of \$2400 a year for graduate school. At Brooklyn Polytechnic for her master's, she enjoyed teaching. Eleanor took another job after graduate



©Hollenshead: Courtesy of NYU Photo Bureau

school but did not like it either. In 1965, she became an assistant professor at the Pratt Institute in Brooklyn. She received her Ph.D. from Brooklyn Polytechnic, and on December 4, 1969, she was initiated into TBII's New York Eta Chapter at CCNY.

In 1984, at Pratt, Eleanor became the first female dean of a U.S. engineering school. She was recruited by Cooper Union and became engineering dean in 1987.

In 1995, Eleanor became the first woman president of the American Society for Engineering Education (ASEE). She was involved in education on a global scale, serving as chair of the Washington Accord, which allows engineering associations to accept professional credentials between countries. Eleanor is a fellow of the Society of Women Engineers, ASEE, and IEEE and has served as president of the Accreditation Board of Engineering and Technology (ABET), as well as on the National Science

Foundation advisory board. She was inducted into the National Women's Hall of Fame in 2007.

Eleanor retired in 2012 after 23 years as dean at Cooper Union. She is active in professional societies, consulting, and traveling. And even though she and her parents worried that she would never marry, she did to a physicist, Paul Baum. They have two daughters and two granddaughters.

To our students, she says to remember the point of being an engineer is to help humanity, to make life better, and improve the quality of life, and condition of society. Regarding one's own professional growth, keep learning. Learn new things, learn new technologies, and you know it's time to move on from a job when you're not learning anything new. Get involved in professional organizations. It's a great way to network, hear about job opportunities, and learn about new technologies.

—Tricia Gomulinski, SD A '98

## What does being a woman have to do with it?

**ANITA H. ROLLO**, *Badge #292 and later Louisiana Alpha '60*, graduated from Louisiana State University in 1960 with a B.S. and in 1967 with an M.S., both in Chemical Engineering. She liked math, chemistry, and physics in high school, so in her senior year Anita told her counselor that she might want to major in chemical engineering. He got out a book, read what chemical engineers do, then told her, "You don't want to do that." So, initially, Anita majored in chemistry at Rice University because it sounded more lady-like, but that didn't last long. She married during her freshman year and transferred to LSU, where her husband was studying petroleum engineering. At LSU, Anita changed her major to chemical engineering.

The primary challenge she faced in completing her degrees was just hard work, like any other engineering student. The slide rule was, however, a unique problem for a woman. How do you carry a slide rule? The guys carried it on a belt around their waist. As a girl, how do you carry it with a bunch of books in your hands? It sounds trivial now, but back then it was a real problem.

It took nine years to complete her B.S. degree and another seven for her master's, since she had three children and took some time off. Anita worked and took night classes while her husband was in graduate school, but was just determined to



finish her degrees. As a female, Anita felt that she had to do really well to prove that she belonged. In college, Anita was such a small minority that she was not really discriminated against, just overlooked.

Anita originally worked for Ethyl Corporation in petrochemical engineering, her favorite thing to do. When they moved to Washington, DC, she worked for an IBM subsidiary, then later IBM itself for 20 years. Anita's last role there was at a development R&D center where she was responsible for chemical and environmental controls for a semiconductor facility. While IBM wasn't close to her first career choice, it all worked out in the end. As a retiree, she enjoys painting (and

noted that she takes a scientific approach to painting), travel, and cooking.

Anita's peer group at LSU got the Women's Badge for her, which she notes was really an ego trip. At the time she was 27 years old, an "old lady" compared to her fellow students. She was aware when TBII membership was finally granted to women and felt it was certainly the right thing to do. Anita never really wanted to be part of anything that was a "women engineers" program. After all, what does being a woman have to do with being an engineer?

—Jenna P. Carpenter, IN A '83

## “RENAISSANCE WOMAN” AND GRANDMOTHER

**(AGNES) RACLARE CORDIS KANAL (1933-2016)**, Badge #158, the daughter of an engineer, was born and grew up in Tucson, AZ. She studied mechanical engineering at the University of Arizona where she fully immersed herself in college life. Raclare was a dedicated student earning excellent marks while also engaging in a wide variety of activities. She threw herself into coursework and when asked about her pursuit of a rigorous major, said she found studying “relaxing.”

She was the first female University of Arizona student invited to join TBII and was awarded the Women’s Badge in her junior year in Fall 1953. She continued her extracurriculars, serving as acting president of the University of Arizona Engineering Council in her senior year. Raclare was the lone female engineering graduate when she earned her B.S. in mechanical engineering in 1954.

Even as a student, Raclare exhibited an expansive view of her opportunities. She knew her engineering education would provide her with a firm foundation for any career choice. She had a global view of her potential impact and early on exhibited a dedication to life-long learning. She took courses to learn about other cultures and became fluent in Arabic with the goal of working and studying in Egypt. Raclare was described as a “Renaissance woman” by the University of Arizona engineering alumni magazine. This is appropriate as she was adept in many disciplines and committed to using her talents to improve the world. In addition to her coursework, Raclare found time for many organizations, including the Pan American League, TBII, and other professional groups. She had an interest and facility for languages and felt that learning them and about other cultures would let her bridge cultural divides.

After graduating, Raclare worked as a computer engineer



for RCA on the Bizmac, RCA’s first commercial computer. Because of her desire to develop her talents and explore other interests, after a few years in industry, Raclare decided to pursue another of her passions. She enrolled in graduate school earning a master’s degree in anthropology from the University of Pennsylvania. There, she met her husband, Laveen Kanal, a student from India who was working on his Ph.D. in electrical engineering. They were married in 1960, having three children, and two grandchildren during 55 years of marriage.

Raclare raised the young Kanal family in rural Pennsylvania and in Maryland after Dr. Kanal joined the faculty at the University of Maryland, College Park. As she had always done, Raclare continued to explore and immerse herself in many scientific and cultural fields, from botany to genealogy and photography to Mexican mariachi.

Raclare’s center was her family—her husband, children, and grandchildren. Additionally, she volunteered for a wide range of causes including rescuing countless small animals. Her contributions were significant; she published a scientific paper on her discovery of a new species of vascular plant and was honored for her volunteer work with the National Park Service and the Family History Center in Washington, D.C. In 2016, a scholarship at the University of Arizona for women engineering students was established in her name. Raclare was honored in 2017 by being one of the first inductees to the University of Arizona Engineering Hall of Fame.

Raclare Cordis Kanal died in 2016 when she was 83. Her life exemplifies all that we stand for in TBII—commitment to integrity, breadth of interest, and quality in all our pursuits.

—Sue L.R. Holl, CA 176

## NUCLEAR RESEARCHER AND LIFE-LONG LEARNER

**SOFIA MILNER LASKOWSKI (1941-2018)**, Badge # 372, was born in Matanzas, Cuba. She wanted to be a chemical engineer from a young age and enrolled in Villanova University in Havana, completing two years of undergraduate work before her family fled the country. They immigrated to the United States in 1960, when Sofia transferred to the Polytechnic Institute of Brooklyn (now New York University). She started the student chapter of the Society of Women Engineers while at Poly and went on to graduate with a degree in chemical engineering as the top student in her class.

Right before graduating, she was awarded a Women’s Badge by New York Zeta. The Summer 1963 *Bent* celebrated Sofia’s accomplishments that spanned two countries. She had worked as a volunteer social worker at two hospitals in Havana. In New York, she worked as a senior lab technician in a study of calcium metabolism in humans. Aside from science and engineering, Sofia was interested in writing poetry and painting, as well as mineralogy, medical research, ballet, and nuclear reactors! The remarkable young engineer was awarded both a scholarship and a fellowship to pursue graduate school in chemical engineering at the University of Minnesota.

She went on to become the first female Ph.D. graduate in the department. After obtaining her doctorate in 1969, Dr. Milner Laskowski started her professional career in nuclear



power plant research and development. She worked in this field until 1980, when she joined IBM, where she stayed for 25 years, enjoying a long and rewarding career. Sofia retired as the program director of intellectual licensing and went on to explore many of her interests and hobbies during retirement. As a life-long learner, she attended photography classes at Foothill College. Her work was exhibited at Foothill, Prague, and Havana.

In 2002, Sofia and her husband Jan established the Jan J. & Sofia Milner Laskowski Fellowship to support promising female graduate students in the chemical engineering department at the University of Minnesota. Their goal was “to give priority to female students in hopes of continuing to increase the fraction of women in engineering, an extremely rewarding and well-paying profession.” To date, at least

14 women engineers have benefited from the fellowship. In a 2013 interview, the couple explained that “they were driven to establish the fellowship since they believed engineering education is critical to the successful growth of the United States and making the world a better place to live.” Indeed, Sofia had made the world a better place through her hard work, dedication to learning, and passion for life. She passed away on October 22, 2018.

—Stefani Kocovsky, NJ 17

## TELL US THE TALE...WIN A T-SHIRT!

SEND US a clever caption for this snapshot from Tau Beta Pi's photo archives! If the judges vote yours as one of the best, and you have *not* been a previous winner, you will win a TBPi t-shirt of your choice.

Here we have a picture from the Alumni Notes department of the Summer 1988 issue of *The Bent* in which (eventual centenarian) Alfred J. Ferretti, MA E 1917, right, former mechanical engineering department chairman and acting dean of the college of engineering at Northeastern University, celebrates his 92<sup>nd</sup> birthday at the Northeastern faculty center. On the left is then TBPi faculty advisor John Zotos, MA E '54.

Submit your entries to [pat@tbp.org](mailto:pat@tbp.org), or mail them to HQ by Monday, May 6, 2019.

The picture below, which appeared in the Fall 1978 *Bent*, shows chemical engineering major Martha L. Tinkle, NM A '79, as she demonstrates her project to George



W. Lucky, Ph.D., NM A '44, their Chapter Advisor and New Mexico State University electrical engineering professor; and Michael E. Austin, Ph.D., P.E., TX A '58, District 13 Director and engineering professor at the University of Texas at El Paso.

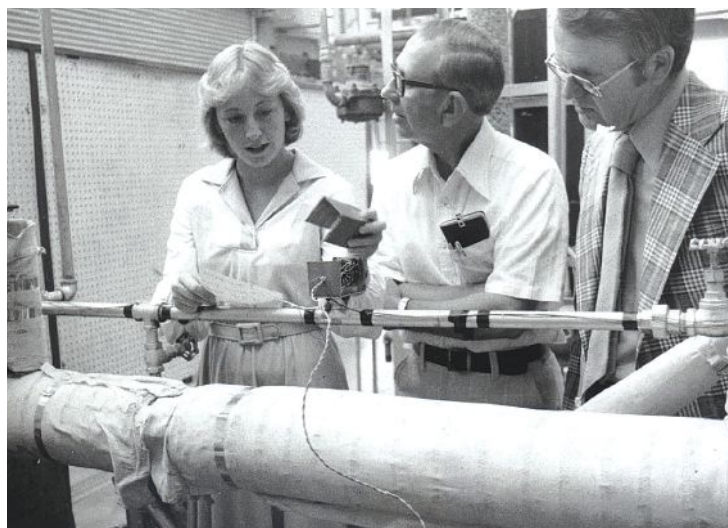
Tau Bates, you have outdone yourselves this time by sending us a NEW all-time record number of 69 captions from 41 prolific readers!! Despite the odds, a definitive winner prevailed with this caption penned by Thomas G. Hausheer, IL B '70: **"Well, we've added the barley, hops, and malt so by my calculations it should be ready to drink in about ten more days."**

The apparently thirsty judges awarded second place to Robert McMillan Jr., MA A '69, for this one of five entries: **"You're telling me this thing cools 24 cans of beer in sixty seconds?"**

There was a tie for honorable mention between Charles I. Balut, P.E., NJ B '68, with **"But does it make coffee as good as my Keurig?"** and this from Tatiana A. Overturf, CA P '18: **"This will be the football team's secret weapon. I call it the t-shirt cannon."**

All 69 submitted captions can be viewed online at [www.tbp.org/pubs/captionContest.cfm](http://www.tbp.org/pubs/captionContest.cfm)

Thanks again to all of you who took the time to share your special brand of humor.





The *TAU BETA PI Chapter Endowment Initiative* was launched in Spring 2014 to fund Association activities that support the collegiate chapters. Major Gifts Officer Sherry D. Jennings-King, Tennessee Alpha '93, pictured at left hanging out with some friends at SLAC National Accelerator Laboratory, shares progress and developments.

# Chapter Endowment Update

**T**HERE IS MUCH GOOD NEWS to report this year on our Chapter Endowment Initiative, by which alumni, companies, and foundations can permanently endow the Association's activities that support any of our 248 student chapters. Last year we reported 45 gifts/pledges and this year we have another 38 to add to the list as we strive to endow all of our chapters.

At this time, endowed chapters at the level of \$100,000 or more include:

California Delta	University of Southern California	\$100,000
California Upsilon	Cal. State University, Sacramento	\$100,000
Illinois Alpha	Univ. of Ill., Urbana-Champaign	\$130,000
Indiana Gamma	University of Notre Dame	\$125,000
Iowa Alpha	Iowa State University	\$110,289
<b>Louisiana Alpha</b>	<b>Louisiana State University</b>	<b>\$100,000</b>
<b>Maryland Beta</b>	<b>University of Maryland</b>	<b>\$100,000</b>
Michigan Beta	Michigan Technological University	\$100,000
Michigan Gamma	University of Michigan	\$104,912
Michigan Epsilon	Wayne State University	\$250,000
Michigan Zeta	Kettering University	\$100,000
<b>New Jersey Delta</b>	<b>Princeton University</b>	<b>\$100,000</b>
New York Delta	Cornell University	\$105,000
Ohio Beta	University of Cincinnati	\$100,000
Ohio Gamma	The Ohio State University	\$100,000
<b>Ohio Epsilon</b>	<b>Cleveland State University</b>	<b>\$100,000</b>
S. Dakota Alpha(1)	S. Dakota Sch. of Mines & Tech.	\$100,000
<b>S. Dakota Alpha(2)</b>	<b>S. Dakota Sch. of Mines &amp; Tech.</b>	<b>\$100,000</b>
Texas Beta	Texas Tech University	\$100,000
Virginia Alpha	University of Virginia	\$115,000
Wyoming Alpha	University of Wyoming	\$100,000

Another five chapters (in bold) were endowed this year. Special thanks to Harry J. Longwell, *LA A '63*,

Yung Bong Lim, *NJ Δ '87*, Thomas C. Crane, *MD B '62*, Stanley Korzep, *OH E '66*, and Larry A. Simonson, *SD A '69*, for stepping forward with these leadership gifts (this is Larry's second one!).

The value of the Chapter Endowment Initiative fund including growth, interest, donations, pledges, and earnings less distributions at the end of Tau Beta Pi's fiscal year (July 31, 2018) was \$3,430,023.79.

## How to Help

There are a number of ways to support this initiative. Checks can be made out to "Tau Beta Pi—The Engineering Honor Society" and sent to Tau Beta Pi, Attention: Curtis Gomulinski, Executive Director, P.O. Box 2697, Knoxville, TN 37901-2697. Other options include gifts of highly appreciated stock held for over one year as well as matching gifts, IRA rollover gifts, and including Tau Beta Pi in your estate plans.

## Tax-deductible

Gifts through this initiative will be reflected in an individual's total giving to Tau Beta Pi. As a non-profit organization, we are exempt from federal income taxes under Section 501(c)(3) of the Internal Revenue Code. Your gift is tax-deductible to the full extent allowed by the law.

**Note:** The minimum gift being accepted for this initiative is \$5,000. All checks received that are designated for this initiative in an amount less than \$5,000 will be paid into Tau Beta Pi's annual fund which supports the same programs as the initiative.

## Contact Sherry

For more information on the Chapter Endowment Initiative, please check out our website at <https://www.tbp.org/give/chapterEndowment.cfm> or contact Sherry Jennings-King, Major Gifts Officer, by phone at (612) 226-2922 or by email to [sherry.jenningsking@tbp.org](mailto:sherry.jenningsking@tbp.org).

## Challenges/Matches

We currently have several challenge matches open in support of the following chapters:

California Epsilon	University of California, Los Angeles	Anonymous	\$15,000
California Eta	San Jose State University	George Treabol, <i>CA H '75</i>	\$20,000
Indiana Epsilon	Trine University	Alan Dausman, <i>IN E '77</i>	\$20,000
Ohio Alpha	Case Western Reserve University	Charles Reed, <i>OH A '34</i>	\$10,000
Ohio Delta	Ohio University	Richard Robe, <i>OH Δ '55</i>	\$20,000
New York Beta	Syracuse University	Charles Chatfield, <i>NY B '32</i>	\$15,000
Pennsylvania Theta	Villanova University	John Hennessy, <i>PA Θ '73</i>	\$25,000

# New Gifts and Pledges Received

<b>Yung Bong Lim, NJ Δ '87</b> for NJ Delta at Princeton University	<b>\$100,000</b>	<b>Daniel K. Case, CA E '87</b> for CA Epsilon at University of Calif., Los Angeles	<b>\$5,000</b>
<b>Longwell Family Foundation, Harry J. Longwell, LA A '63</b> for LA Alpha at Louisiana State University	<b>\$100,000</b>	<b>Paul A. Cocotis, CA A '90</b> for CA Alpha at University of California, Berkeley	<b>\$5,000</b>
<b>Capt. Thomas C. Crane, MD B '62</b> for MD Beta at University of Maryland	<b>\$95,000</b>	<b>Brian M. Crawford, IA A '04</b> for IA Beta at University of Iowa	<b>\$5,000</b>
<b>Stanley Korzep, OH E '66</b> for OH Epsilon at Cleveland State University	<b>\$88,000</b>	<b>Billy W. Friar, Ph.D., VA B '58</b> for VA Beta at Virginia Poly. Inst. & State Univ.	<b>\$5,000</b>
<b>Larry A. Simonson, Ph.D., P.E., SD A '69</b> for SD Alpha at S. Dakota Sch. of Mines & Tech.	<b>\$80,000</b>	<b>Mary and Clinton R. Gilliland, GA A '59</b> for GA Alpha at Georgia Institute of Technology	<b>\$5,000</b>
<b>T. Richard Robe, Ph.D., P.E., OH Δ '55</b> for OH Delta at Ohio University	<b>\$25,000</b>	<b>John A. Hertneky, PA B '79</b> for PA Beta at Pennsylvania State University	<b>\$5,000</b>
† <b>Charles F. Chatfield, NY B '32</b> for NY Beta at Syracuse University	<b>\$21,577</b>	<b>Irwin M. Jacobs, Sc.D., NY Δ '56</b> for CA Psi at University of California, San Diego	<b>\$5,000</b>
<b>Paul E. Benneche, VA A '74</b> for VA Beta at Virginia Poly. Inst. & State Univ.	<b>\$20,000</b>	<b>Dennis C. Jerome, MS A '67</b> for MS Alpha at Mississippi State University	<b>\$5,000</b>
<b>Kathleen L. Colbry, Ph.D., MI A '99 and Dirk J. Colbry, Ph.D., MI A '06</b> for MI Alpha at Michigan State University	<b>\$20,000</b>	<b>Howard E. Jessen, CA B '46</b> for CA Beta at California Institute of Technology	<b>\$5,000</b>
<b>Nicholas M. Donofrio, NY Γ '67</b> for MD Epsilon at Morgan State University, \$5,000 for NY Beta at Syracuse University, \$5,000 for PA Zeta at Drexel University, \$5,000 for TX Theta at University of Texas at El Paso, \$5,000	<b>\$20,000</b>	<b>Ken and Beverly Jinkerson, MO B '75</b> for MO Beta at Missouri Univ. of Science and Tech.	<b>\$5,000</b>
<b>Robert H. Tolson, VA B '58</b> for VA Beta at Virginia Poly. Inst. & State Univ.	<b>\$20,000</b>	<b>Robert E. Levin, Ph.D., CA Γ '53</b> for CA Gamma at Stanford University	<b>\$5,000</b>
<b>R. Dudley White, VA A '76</b> for NY Gamma at Rensselaer Polytechnic Institute	<b>\$20,000</b>	<b>Earl W. McCune Jr., Ph.D., CA A '79</b> for CA Lambda at University of California, Davis	<b>\$5,000</b>
<b>Anonymous, CA E '83 and '85</b> for CA Epsilon at University of Calif., Los Angeles	<b>\$20,000</b>	<b>Paul F. Penko, Ph.D., OH Δ '67</b> for OH Delta at Ohio University	<b>\$5,000</b>
<b>James S. Eastman, WA A '53</b> for WA Alpha at University of Washington	<b>\$10,000</b>	<b>Yvonne R. Roberts, AL A '95</b> for AL Alpha at Auburn University	<b>\$5,000</b>
<b>Roy F. Quick Jr., MA B '70</b> for MA Beta at Massachusetts Institute of Technology	<b>\$10,000</b>	<b>Murray E. Rudin, J.D., NY K '83</b> for NY Kappa at University of Rochester	<b>\$5,000</b>
<b>G. David Thayer, CO B '57</b> for CO Beta at University of Colorado at Boulder	<b>\$10,000</b>	<b>Bobby S. Shackouls, MS A '72</b> for MS Alpha at Mississippi State University	<b>\$5,000</b>
<b>Robert M. Ferencz, Ph.D., OH A '80</b> for OH Alpha at Case Western Reserve University	<b>\$6,801</b>	<b>William F.H. Sinclair, MS A '63</b> for MS Alpha at Mississippi State University	<b>\$5,000</b>
<b>Arthur J. Beutler, WI A '48</b> for WI Alpha at University of Wisconsin-Madison	<b>\$5,000</b>	<b>Mark C. Smith, OR A '89</b> for OR Alpha at Oregon State University	<b>\$5,000</b>
		<b>Anonymous, DE A '70</b> for PR Alpha at University of Puerto Rico	<b>\$5,000</b>
		<b>Anonymous, TN B '71</b> for PR Alpha at University of Puerto Rico	<b>\$5,000</b>

# Capt. Thomas C. Crane, MD B '62

*The Captain Thomas C. and Barbara M. Crane Endowment for the Maryland Beta Chapter at The University of Maryland*

**b**ORN IN BALTIMORE and raised in Catonsville, MD, Tom knew early on he was heading for a career in engineering. Following his graduation with honors from high school and having participated as a class officer and athlete, he set his sights on the University of Maryland, College Park, where several of his classmates were headed. Tom's parents were strong supporters of education and encouraged his plans. "My father didn't finish college and struggled his whole life to get ahead even though he had good jobs. He wanted to make sure that I attended and finished college so I would have a good opportunity at a career." Tom's strength lay in math so he decided to pursue an undergraduate degree in civil engineering.

Upon graduation with his undergraduate degree, Tom joined the Navy's Civil Engineer Corps. He attended Officer Candidate School in Newport, RI, and trained further in California in preparation for his first tour in Guam. When Tom received his orders to report for service in Puerto Rico he had just gotten married in Port Hueneme to Barbara, who hailed from Camarillo, CA.

During his time in Puerto Rico, he was selected for the Navy's Shore Nuclear Power Program graduate school and graduated with a master's degree in that field from Pennsylvania State University in December 1969. As a qualified officer-in-charge, he made four trips to Antarctica at the nuclear power plant there which supported National Science Foundation projects at McMurdo Station. Toward the end of his time on this tour, he was responsible for the plant decommissioning noting that the project took five years as the station is in international territory and had to comply with the Antarctic Treaty of 1959 as well as United States transportation regulations.

## **Executive Officer**

Upon his return to San Diego, Tom became executive officer of the amphibious construction battalion responsible for "ship to shore" supplies for beach support in the event of an invasion. Later he was in charge of naval construction in the northwestern states and built a one-of-a-kind nuclear refueling facility at the Puget Sound naval shipyard which was the largest and most technically difficult construction project of the Navy in 1981. Subsequent years found him based in Hawaii building a remote over-the-horizon radar site on the Aleutian Islands chain and later he became commanding officer of the Public Works Center in San Francisco

during the time of the Loma Prieta earthquake in 1989. When the quake hit, he was living on Yerba Buena Island and ran the short distance to the freeway to begin directing traffic for those stranded on the Bay Bridge. In the following days, "We had to deal with over 600 instantaneous utility breaks... water and sewer lines, damaged runways, unusable freeways, and collapsing buildings." He returned to the San Diego area and focused on consolidating engineering services on the West Coast for the Navy which included housing and military construction as well as environmental remediation work.

Tom retired in 1993 with the rank of Captain after a 31-year career. During that time, he was awarded three Legion of Merit medals and five Meritorious Service Medals for his service to our Nation.

Shortly after retirement, he launched his sole proprietor consulting business that he ran for around 13 years. During this time, he also volunteered for the San Diego Police Department. In 2009, he was hired as

an assistant director in the Public Utilities Department for the City of San Diego consolidating their water and wastewater departments where he stayed until 2018.



## **Respecting Others**

Reflecting on his teen years, Tom mentioned the importance of being flexible and respecting others' positions and ideas. He adds, "In college I received a scholarship my senior year that helped me finish my schooling. I promised I'd establish a scholarship at the University of Maryland when I could, and I've now had two scholarships established for the past decade."

As for the engineering students today he advises, "Try to get as much business management training and education as you can so when you get out it's not just pure engineering that you've learned. It's important to be a businessperson in the engineering world."

Tom shares that the Chapter Endowment Initiative resonated with him and solidified his decision to endow the Maryland Beta Chapter because, "I want to be sure the students from Maryland Beta have the same opportunities available to them in the future such as attending the annual Convention, and participating in the leadership training activities Tau Beta Pi offers."

# Larry A. Simonson, Ph.D., SD A '69

The Tricia E. Gomulinski Endowment for the South Dakota Alpha Chapter at South Dakota School of Mines & Technology

Many alumni are familiar with Larry Simonson, a past TBI President, through his travels in a red Prius, handing out jellies and jams he made with fruit harvested in South Dakota to members across the country. Retired from teaching electrical and computer engineering at the South Dakota School of Mines & Technology in 2009, he now serves as the school's assistant to the president—alumni ambassador.

In 2014, he made a \$100,000 gift to establish an endowment for the South Dakota Alpha Chapter through the Chapter Endowment Initiative in honor of his former student, the late Shawn R. Schwaller, SD A '95. He is now establishing a second endowment for the chapter to honor his former student and Shawn's widow, Tricia Elizabeth Schwaller Gomulinski, SD A '98. This is the first time one of our chapters has received two such endowments and he shares that the gift is to support opportunities for Tau Beta Pi noting, "I have tremendous admiration for the work that the leadership of the Association is doing to promote new activities that will support creativity amongst members. The Society needs people with engineering-thinking skills to step into leadership positions."

## Former student

Growing up in eastern South Dakota, Tricia was encouraged by high school teachers to pursue her strengths in science and math. She set her sights on attending SDSMT as it was a smaller, reputable school. Initially she gravitated toward computer science as a major but friends double majoring in electrical engineering and computer science convinced her to do the same. Tricia's education took six years as she co-oped at Rockwell Collins in Cedar Rapids, IA.

Simonson was one of the first people she knew on campus as she had him for four of her electrical engineering classes. He was Chief Advisor of South Dakota Alpha, and she noted that he paid particular attention to the double majors in his classes as computer science majors at the time were not eligible for membership. Tricia was initiated in 1995 and elected as corresponding secretary right before South Dakota Alpha hosted TBI's 1996 annual Convention. "I had been out on co-op during the spring semester and had not kept track of campus events until I came back and was quickly recruited as a gopher and tour guide at Convention. This was also during the time when it was common for the official banner to be

stolen so I had to keep an eye on it as well." The following year, she was elected president of the chapter and graduated in May 1998. Larry hosted Tricia's graduation party at his house and welcomed her parents, grandparents, and extended family members there. She also remembers

when Larry and some non-voting delegates left the Manhattan, KS, Convention early on Saturday afternoon hightailing it up to Sioux Falls to crash her and Shawn's wedding reception.

Upon graduation, she narrowed her job choices down to Rockwell Collins and Raytheon. As Shawn had been three years ahead of her in school and was working for Rockwell Collins, they decided to make a change and go with Ray-

theon in Colorado. Tricia was a software engineer working in satellite communications. She stayed for 13 years and, by then was leading a team of 16 engineers, many of whom she had worked with since her first days at Raytheon. While in Colorado, Tricia continued to volunteer with TBI serving with Simonson, Wade Hull, and Lindy Johnson as District 12 Directors.

After she moved to Knoxville, TN, the Executive Council in 2013 appointed Tricia as Director of Alumni Affairs, a volunteer post. "When I got to Headquarters, I saw that no one on the staff had the bandwidth to take on outreach to our alumni so I decided to take it on." Tricia has now been in this position for over five years. "It always makes you feel good when you go to a new place that no one has been to before and you show up and everyone turns out in droves wanting to hear about what's going on with Tau Beta Pi. When I started, we had 18 active alumni chapters and now we are up to 44. In the past it was typical to have around six alumni chapter representatives at Convention. Now we are up to around 30."

While working full-time as a technical manager at Teledyne Brown Engineering, another focus of Tricia's has been on encouraging annual celebration by students and alumni of Pi Day on March 14. "Each year we have more chapters participating in activities such as giving out slices of pie, having pi mile runs/walks, pie-eating contests, reciting pi competitions, you name it." Tricia adds, "The best part of the work is reconnecting alumni with the Association."

Of Larry's gift in support of the Chapter Endowment Initiative, Tricia notes, "At this point I've known Larry for over half my life. The initiative is a very good opportunity to help TBI while supporting your own chapter. I am honored that Larry has done this a second time."



# Yung Bong Lim, NJ Δ '87

*Endowment for the New Jersey Delta Chapter at Princeton University*

**I**T IS NO WONDER that Yung Bong Lim studied engineering. “I come from a family of engineers —my father was a civil engineer, my brother studied electrical engineering, and my brother-in-law got a Ph.D. in electrical engineering.” But for one so steeped in our field, he often reflects on the lessons he learned not just in engineering but also his liberal arts classes. Also, Yung firmly believes in keeping an open mind for the opportunities that may arise throughout life brought about by luck or timing and being able to seize upon them by proving yourself in all assignments, even if they involve menial work in less glamorous jobs.

Born in Seoul, Korea, Yung attended Manila International School in the Philippines, showing an aptitude for math and sciences. He first came to the U.S. when he enrolled at Princeton University. He studied electrical engineering and, as a Tau Bate, served as the NJ Delta chapter president. He graduated in 1987 summa cum laude and was inducted into Phi Beta Kappa.

During his senior year, Yung considered jobs in investment banking and consulting in addition to engineering, keeping options open because of his immigration status as a foreign student. Ultimately, he accepted a position at Salomon Brothers in New York as a quantitative analyst, deciding to combine his technical background with finance, and planning to one day go to business school.

Wall Street in the 1980s was an exciting place. Yung went through the Salomon Brothers sales and training program and was initially assigned to a project on electronic publishing involving Sun workstations. Because of this work, he was then placed into the arbitrage support group, where he ported programs over from minicomputers to Sun workstations, providing him exposure to the analytics behind the trading models. As new securities were being created, investment banks would send over schedules of cash flows and the researchers asked him to enter thousands of numbers into their pricing systems. He proved his reliability with the tedious work, and the researchers gained confidence in him, explaining the analytics and giving him more responsibilities.

Yung enjoyed his work at Salomon Brothers and chose to forego business school. He progressed in research, and then trading, staying for 11 years in the firm’s Proprietary Fixed Income Trading group, focusing on mortgage-backed securities, and eventually becoming a managing director. In 1998, his department was suddenly shut down, and he found himself unemployed. He then joined Citadel Investment Group in Chicago in 1999,

where he started the mortgage-backed securities trading group, which he ran for eight years. Yung left the hedge fund world in 2007, and he saw the first signs of the housing market decline. He decided to invest in distressed real estate and, in 2008, founded RDG Funds LLC, where he is presently the Managing Partner. RDG is a private equity real estate investment firm based in Chicago that invests in various markets in the U.S.

Reflecting on his time at Salomon Brothers, Yung notes that, over his 11-year tenure, he saw several periods of turmoil and experienced departures of many senior personnel. He credits his decision to stay and weather the storms for opportunities to learn through all the ups and downs, picking up on what should be done during times of trouble as well as mistakes that can be avoided during good times. He notes, “It pays to stay in a place and learn through the thick and thin.”

Yung also credits college classes for lessons and concepts that have come in unexpectedly handy. In a class where he studied operating systems, he learned about principles of allocating CPU resources to tasks of different priorities—that you cannot just always focus on the highest priority task, but that you need to also appropriately allocate resources to less important work. Similarly, in both personal and professional life, you have to avoid being trapped by the “tyranny of the urgent.” In a sociology class, he recalled learning about the famous Kitty Genovese case in the 1960s. The concept of diffusion of responsibility struck Yung, and he keeps this in mind in order to emphasize accountability when he leads his team. He also stresses the critical importance of integrity in all parts of our lives, noting that it is paramount regardless of what type of work we do. He cites Warren Buffet, who once said that the five most dangerous words in business may be, ‘Everybody else is doing it.’

Besides his professional work, Yung serves on the boards of Invesco ETFs, Performance Trust Capital Partners, Beacon Power Services, Princeton Internships in Civic Service, Princeton Faith & Work Initiative, and Chicago Fellowship. He has been married for 18 years, and he and his wife actively support and volunteer with various ministries and non-profit organizations. They have two teenage sons.

Of his support for the NJ Delta Chapter through the Chapter Endowment Initiative, Yung notes, “This investment in Princeton engineering students will hopefully ensure that they will continue as well as expand their activities. I look forward to seeing their successes.”



# Harry J. Longwell, LA A '63

*The Longwell Family Endowment for the Louisiana Alpha Chapter at Louisiana State University*

**b**ORN IN BUNKIE, LA, Harry J. Longwell's work ethic developed when his family moved to nearby Alexandria to establish a second-hand furniture store and household moving company. After clamoring to be involved, he held down his first job at six-years old as a shoe-shine boy (a nickel during the '40s) on Saturdays with his mother's admonishment, "Do not mess up the customer's shoes."

Harry has been hard at work ever since and was the second in his immediate family to attend college. From his days at an all-boys parochial school, Menard Memorial, he learned about engineering from professional/career day discussions. "I'm an outdoor person and saw engineers as 'outside people' who worked with their hands and had technical expertise." He also had exposure to engineers through an aunt who was a fuel supplier in Grand Isle, LA, in the early days of offshore work. She thought highly of those in the oil industry.

He set his sights on Louisiana State University as it was the biggest school in the state with the most options including petroleum engineering. Harry and his wife, Norma, were married between his sophomore and junior years and had the first of four sons a year later. Their second son arrived within another two years giving motivation to find a good job as soon as he could after graduation. The Suez Canal Crisis was around this time and enrollment in petroleum engineering dropped. During his junior year, a counselor told him there was no future in the field and suggested he get out immediately. "Oil was \$1/barrel, but I stayed with what I thought I wanted to do."

## **Began Exxon Career**

Harry began his career with Exxon as a drilling engineer in Exxon Company, U.S.A.'s (Humble Oil) production office in New Orleans. After a number of assignments in Louisiana, California, Texas, London, and New Jersey, he returned to Houston as president of Exxon Company, U.S.A. in 1992. He was elected senior vice president of the corporation and director in 1995. Harry was named executive vice president of the corporation in 2001. He retired as a director and executive vice president of Exxon Mobil Corporation in Dallas after more than 41 years with the company. His primary responsibilities included the corporation's worldwide oil, gas, coal, and minerals exploration, and production activities and human resources.

Harry is a Distinguished Member of the Society of Petroleum Engineers and a member of the All American Wildcatters. Among other professional, civic, and philan-

thropic activities over the years, he served on the executive committee of the board of directors of the National Action Council for Minorities in Engineering, chairman of board of trustees of University of Dallas, and chairman of M.D. Anderson's Cancer Center Board of Visitors and a life member of that board. Harry received an honorary doctor of science degree from LSU in August 2004 and was named alumnus of the year in 2005.

He cites his greatest accomplishment beyond his family as his career at Exxon Mobil, rising through the ranks after starting as a new hire at 22-years old and coming into the workplace knowing no one. "Through my career I enjoyed working with thousands of very highly-capable people in all disciplines and doing it reasonably successfully with high standards and expectations, but none higher than I expected from myself," adding, "And I was able to instill that in most without discouraging them." He credits the strong values he carried into his career with growing up working in a small family business. "I saw early on the importance of dedication to what you

were doing regardless of the level of sophistication it took and how to work with people at all levels who respected each other and got the job done." Harry is also proud that his oldest son, Harry III, has pursued a successful engineering and management career at Exxon Mobil as well.

With today's rapidly changing technology, Harry notes, "It's more important than ever in engineering studies to understand the fundamentals of various disciplines and then be very open-minded and creative in terms of how those fundamentals can be taken to the next level. That's what continues to drive the explosion in technology today." Students must also, "Have a strong work ethic that is unmatched by anybody else and an ethical, moral approach to everything you do."

Harry and Norma's gift through the Longwell Family Foundation to endow the Louisiana Alpha Chapter at Louisiana State through the Chapter Endowment Initiative stems from decades of his family's involvement with the chapter. To date, three generations have been initiated, including himself, son Paxton John Longwell, M.D., LA A '86, and grandchildren (Paxton's children) Madison Elizabeth Longwell, LA A '17, and Harrison John Longwell, LA A '19. Harry notes that with an LSU engineering degree you have "the ticket to ride" enabling good, professional employment immediately out of school. "Engineering is the most important college in the university. It is the excellence in academic achievement and application that is most important, and that is what Tau Beta Pi recognizes."



# 2018-19 Alumni Giving Program November-January Contributors

The names of 3637 Tau Beta Pi alumni who made donations to the Association in the 2018-19 Alumni Giving Program appear in two separate sections on the following pages. Their gifts totaling \$856,803 arrived between November 1, 2018, and January 31, 2019. Names preceded by SPEC denote gifts from non-members. Gifts received after January 31 do not appear here but will be published in the Summer 2019 issue of The Bent.

The generous support of each member is deeply appreciated by the Executive Council and other Association Officials. The financial resources have permitted strengthening our programs in several areas that emphasize the importance of Tau Beta Pi's basic objectives and that help all collegiate chapters and student members.

Recognition Club Donors are listed alphabetically within their chapters and appear in the first section below. Member-contributors appear in the subsequent section. Names marked with a † symbol are of deceased members in whose memory donations were made either by relatives and friends or through bequests. In addition to gifts acknowledged here, several were made anonymously through the Combined Federal Campaign and are also deeply appreciated.

## Donor Recognition Clubs

The names of 2924 Tau Bates appear in this first section. They made donations to the Alumni Giving Program between November 1, 2018, and January 31, 2019, AND they have also made CUMULATIVE contributions (in some cases including matching gifts) and bequests to Tau Beta Pi through the years totaling from \$250 to more than \$1,000,000.

The Donor Recognition Clubs are part of our effort to recognize a donor's total lifetime cumulative giving to Tau Beta Pi. Such continuous support significantly contributes to the overall strength of the Association and allows our Society, with confidence in our financial resources, to plan for modest growth in our services to the engineering profession. These clubs were chartered by the Executive Council in 1986 and have been set at the following levels:

Matthews Club	500,000	Alpha Club	25,000	Chi Club	1,000
Nagel Club	250,000	Beta Club	10,000	Second Century Club	500
Williams Club	100,000	Delta Club	5,000	Founders Club	250
Heikes Club	50,000	Zeta Club	2,500		

### WILLIAMS CLUB

IL A Holland Jr., Lester M. '66  
LA A Longwell, Harry J. '63  
NY E Lynnworth, Lawrence C. '58  
OH E Korzep, Stanley '66  
RI A Anonymous '72  
SD A Simonson, Larry A. '69  
TX A Brill, Arno William '71

### HEIKES CLUB

CT A Soderberg, Peter Holton '68  
MI † Clark, Terry Blue '69  
MI E Anderson, James Anton '66  
OR A Brandt, Larry Don '67

### ALPHA CLUB

CA A Kepler II, David Edwin '75  
CA E Pappone, Daniel Charles '77  
IN A Ford, Steven Richard '80  
Newcomb, Robert Wayne '55  
LA † Kitchens, Philip Hudgins '67  
MI Z Thebert, Alan Wilbert '57  
OH A Robe, Richard '55  
OH E Pasadyn, Ronald Chester '70  
TX A Yates Jr., Peyton '65

### BETA CLUB

CA B Jessen, Howard E. '46  
CO A Armentrout, Michael Lee '74  
CO B Anonymous '78  
Thayer, G. David '57  
DE A Gutshall, Thomas Lee '60  
Anonymous '70  
FL B Crews, Renard Calvin '70  
GA A Gilliland, Clinton R. '59  
IN A Sarkisian, Nancy Louise '77  
IN † Rice Jr., Donald Blessing '61  
IN E Dausman, Alan Vernon '77  
LA † Samuels, Katie '86  
MD B Crane, Thomas Clemson '62  
MA B Quick Jr., Roy Franklin '70  
MA † Fenton, Harvey Albert '58  
MI A Colbry, Dirk J. '06  
Colbry, Katy Luchini '99  
MI † Anonymous '78  
Crouch, Dennis Eugene '62  
† Simmons, Charles David '50  
MI E Gomulinski, Curt Dennis '01  
MS A Jerome, Dennis C. '67  
Shackouls, Bobby Stone '72  
MT B Samuels, Blake Robert '84  
NH A Sherman, John Lincoln '54  
NJ † Bezos, Jeffrey Preston '86

NY A Florman, Samuel C. '44  
NY † Van Wageningen, William '78  
NY K Knox, Keith Thomas '70  
Rudin, Murray Edward '83  
NC A Johnson Jr., Jim William '77  
OH B Throckmorton, Dean W. '82  
RI A Vigar, Judith Wells '83  
SD A Gomulinski, Tricia E. '98  
TN A Pih, Norm '82  
TX A Knight, Graham B. '48  
UT A Morrison, Michael G. '88  
WAA Eastman, James Scoville '53  
WI A Beutler, Arthur Julius '48  
Anonymous '64  
WI B † Hurlbert, Gordon C. '46  
WI † Crouce, Richard Gordon '77

### DELTA CLUB

AZ A Milan, John M. '67  
AZ B Story, Franklyn H. '81  
Stout, Roger Paul '77  
CA B Lippey, Jerry '55  
Shombert, Lee Alan '79  
CA † Tyson Jr., James J. '58  
CA † Davis, John Leo '60  
CA E Miller, Jeffrey Clark '83  
Tozaki, Ronald Yuji '74  
CA † Koblitz, Gordon Frank '66  
McClay, Michael Dennis '73  
CA I Pickett, Stephen Euan '75  
CA † Domning, Edward E. '84  
Holl, Sue '76  
CA N Caddock Jr., Richard E. '72  
CA O Turhollow, Charles B. '81  
CA T Fable, Scott Edward '96  
CO A Knight, William James '79  
CO B Harris, James Robert '68  
Kidd, T. Wayland '44  
CO † Laughlin II, George T. '75  
DC B Youseffmir, Paul '78  
FL A Anonymous '99  
Anonymous '00  
Bolton, Charles Houston '62  
Kalter, Howard Leo '66  
Shacter, Philip '79  
IL A Fue, Harold '57  
Tracy, Mark Alfred '86  
IL B Bernhardt, John E. '89  
IN A Barker, Kenneth Dale '64  
Davidson, Charles Dean '72  
Ricks, Stephen Wayne '63  
Sedlacek, Warren R. '45  
IN A Brandt, Daniel Melvin '74

Spring, Bradford Hall '59  
Stechholz, Jonathan M. '72  
IA A Carlson, Mary Terese '78  
Crawford, Brian M. '04  
IA B Carson, David N. '54  
Glasgow, Justin Mathew '05  
LA A Comeaux, Keith A. '89  
LA B Legendre III, Emile J. '60  
LA E Champagne Jr., Pierre '76  
MD B Sabio, Vincent Joseph '86  
MA A Duris, Robert Alan '74  
MA B Freeman, Reed Harlow '61  
Goldstein, Andrew Carl '69  
MA † Coutts, Robert Bruce '72  
Patkin, Murray Solomon '64  
MA E Sladek, John Richard '77  
MA Z Lewis, Nelson David '73  
Walker Jr., William E. '57  
MI † Battel, Steven J. '79  
Fay, John Edward '56  
MI E Frye, James Henry '51  
Tillingier, Steven Jay '68  
MO † Gibbs, Kenneth Paul '76  
Kilert, Albert Harold '63  
MT A Royer, Erind George '61  
NE A Walcott, Gwen Sharyn '82  
NHA Dyciewicz, Vickie Sue '96  
NJ A Post, Edwin Lewis '62  
NJ † Petruich, Raymond A. '84  
NJ † Mendelsohn, Andrew J. '77  
NMB Slominski, Paul '78  
NY † Kemp, Thomas Ward '59  
NY H Butterman, Heidi Carol '79  
NY I Judd, Robert Paul '78  
NY N Weber, Thomas William '53  
OH † Ross, Elliot Bennett '69  
OK A Hall, Ralph Roy '64  
OR A Lynch, Stanley Clark '73  
PA A Wagner, Theodore W. '71  
PA Z † Feldbaumer, William C. '51  
PA H Hetteche, Ray Raymond '61  
PA † Gigliotti, Michael Philip '73  
PR A Garcia, Carlos E. '77  
SC B Daley, Leslie N. '71  
Gibbons, Joseph H. '56  
TN A Cook, James Michael '72  
Froula, Jim DeWayne '67  
TN B Layne, Peggy Edith '80  
TX A Anonymous '63  
Mickelson, Kent Burdell '77  
TX B Tye III, John M. '67  
TX † Barrett, Jerry George '70  
UT A Eide, Eric Norman '89

VA A Benneche, Paul Eric '74  
Brown, Lee Merry '88  
Pitzer, William Groh '75  
VA B Breaser, Jeffrey William '83  
Carpenter, Joseph A. '63  
Tolson, Robert Heath '58  
WAA Gunter, Robert Arnold '62  
Pierce, Russ W. '70  
WAB Cass, Robert Dennis '83  
WI A Yee, Paul Yuen-Po '70  
WI † Wilhelm, Mark Robert '77

### ZETA CLUB

AL A Roberts, Yvonne Renee '95  
AL † Koelbl, Terry Gene '84  
AZ A McIntosh, Duncan M. '65  
Seabury, David G. '82  
AR A Biggadike, Robert H. '58  
Gunderman, Tony R.d. '89  
Newtown Jr., Glenford '69  
CA A Edgar, Tim Matthew '08  
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 Nicols, George '85  
 Pearl, John Christopher '61  
 Prescott, Thomas J. '69  
 Reines, Jose '59  
 Roof, Richard Rundel '51  
 Sanguinetti, John W. '70  
 Scott, Richard A. '57  
 Seidel, E. Michael '62  
 Siewiorek, Daniel Paul '68  
 Stagner, Charles Evan '86  
 Stewart, Steve Russell '66  
 Taylor, Mark Edward '74  
 Toliver, Christopher M. '74  
 Walker Jr., H. '58  
 Williamson III, Warren '53  
 Zuk, David Michael '70  
 MI A Elward, Robert M. '75  
 Minnich, Katherine P. '78  
 Rutkowski, Paul John '69  
 MI E Brooks, Vern Eugene '60  
 Durisin, Michael John '81  
 Kellar, James Stephen '60  
 King, James B. '65  
 MI Z Cookman, Jordan C. '94  
 Foraker Jr., David E. '58  
 Haines, John Gregory '72  
 Lachele, Roger Eric '75  
 Roth, Maureen Lynn '91  
 Sadlo, Thomas George '77  
 Searlatelli, Michael G. '76  
 MI H Harder, Shawn Jay '80  
 Johnson, Robert Allen '83  
 Johnston, Richard '78  
 Lundstrom, Richard R. '64  
 MI K Seymour Jr., Richard L. '97  
 MNA Ashley, Gary Charles '69  
 Ball, William Lewis '70  
 Duschka, Lloyd Arthur '45  
 Goodwin, Robert Wayne '62  
 Holm, John David '62  
 McLeod, Gary Wayne '70  
 Osen, John Walter '81  
 Polacek, James Hills '52  
 Sandell Jr., Nils Richard '70  
 Severson, John Albert '72  
 Tucker, Randolph Lewis '83  
 MS A Cargile, James Donald '81  
 Hotard, Daniel Gerard '76  
 †McDonald Jr., Harold R. '65  
 Mills, Marvin Leon '65  
 Stephens, Jack David '83  
 Tisdale, Stanley Ray '78  
 Yates, Karen '73  
 Yates, Michael D. '74  
 MS B Miles Jr., John Hubert '71  
 Valentine, Clifton C. '68  
 MO A Crabbe, Emmanuel F. '81  
 Currie, Wayne Lee '59  
 Donaldson, Albert L. '75  
 Geers, Arthur Edward '48  
 Oehrke, Timothy Chris '75  
 Stiefermann, Michael C. '86  
 MO B Bondi, James Oliver '71  
 Boston, Lawrence Allan '60  
 Ernest, Terry Lee '82  
 Feurer, John Alphonse '70  
 Hahn, Gail Louise '82  
 Jenkins, Glenn Willard '59  
 Kyser, Dale Anthony '83  
 Patterson, Michael A. '77  
 Sedovic, Pete Stephen '81  
 Stevens II, Oramel Dale '72  
 Zimmick Jr., Harold E. '64  
 MO G Apanel, Anna Maria '80  
 Burgi, Charles Edwin '51  
 Byrne, Clare Theresa '78  
 Dyson, Karen A. '81  
 Dyson, Peter Bernard '80  
 Fisher, John William '56  
 Anonymous '99  
 Wildermuth, Amy J. '94  
 MT A Courville, George E. '59  
 Egeland, Monte Dean '81  
 Osgard, Dennis M. '62  
 NE A Criswell, Marvin E. '65  
 Hoffman, Ernest G. '68  
 Kaminski, Wayne Alan '79  
 Langford, Susan K. '90  
 Schaufelberger, Don E. '49  
 Steube, Milan Ray '74  
 NHA Bailey, Joseph Gregory '86  
 Greene, Prescott '57  
 Scharfe, Alan Charles '78  
 NJ A Ghosh, Subhendu '89  
 Hoyt III, John George '76  
 MacMillan Jr., Duncan '66  
 Murphy, Kevin Jay '78  
 Seventko, Joseph M. '60  
 Sussmann, Kenneth P. '72  
 NJ B Cohen, Robert Bruce '77  
 Herrmann, Eric Peter '69  
 Kaufman, Peter Andrew '84  
 Kiser, Donald Owen '52  
 Rabin, Dan E. '73  
 Tanner, Bob Brand '64  
 Wollmann, Norman P. '81  
 NJ G DeWaal, Johannes '70  
 Moeller, Peter Allan '78  
 Pecca Jr., John Anthony '87  
 Pinto, Dick Cunha '56  
 Reitano Jr., Anthony J. '72  
 Tucker, John Harold '67  
 Vandemeulebroeke, Leon '89  
 NJ A Lisle Jr., Thomas K. '69  
 Meyer, John Edward '81  
 Mills, Franklin Perry '84  
 Wolff, Richard John '72  
 NMB Busch, Robert Douglas '72  
 Farber, Martin John '75  
 Salas, Thomas M. '85  
 Turner, Diane '78  
 NY A Au, Peter Yung Tak '93  
 Silbert, Glenn Richard '75  
 Zimmerman, Robert W. '77  
 NY B Bickley, Thomas Duane '78  
 Chandler, George Dennis '70  
 Monson, John Arthur '58  
 Spearot, James Anthony '67  
 Storrs, Edward Lee '81  
 NY G Blakeman II, Robert D. '89  
 Bornhorst, Bernard R. '60  
 Bruch, Charles Gregory '59  
 Curtis, Justin Alan '60  
 Joyce, Michael Edward '82  
 Lequar, James Kay '87  
 Lynch, Karen Michelle '86  
 Pennisi, Joseph Michael '89  
 Roberts, John Walter '86  
 Sacks, Alexei Hiram '90  
 Schultz, Stephen Parker '70  
 Staudinger, James R. '77  
 Walczak, Dennis James '76  
 Walter, Buff Arthur '60  
 Weinberg, Richard S. '81  
 NY A Bauer, Douglas Cufford '61  
 Harris, Dennis George '70  
 Heineman, Duane Thayer '58  
 Hui, Eric C. '90  
 Jureller, Steven Francis '87  
 Matyas, Robert M. '52  
 McCloskey III, Charles '71  
 Sasso, Joseph Allen '70  
 Teng, William L. '74  
 NY E Bernstein, Joseph H. '50  
 Dobbins, Bob Mark '73  
 Kammenzind, Henry A. '50  
 Koehler, George Richard '63  
 Kuhn, Alfred '57  
 McConnell, Donald P. '71  
 Rosen, Fredric Kenneth '62  
 Rubin, Lowell '61  
 NY Z Choma, Peter '73  
 Chu, Lawrence Joseph '71  
 Labianca, Frank M. '61  
 Lopinto, Robert Anthony '67  
 Mendel, Jerry M. L. '59  
 Parisse, Richard F. '61  
 Sindle, Fred H. '59  
 Tartanian, Charles N. '58  
 NY H Bergh, Gerald Kenneth '58  
 Beron, Michael '71  
 Kushel, Glenn Elliot '68  
 Lauer, Spencer David '67  
 Minton, Evelyn Ann '73  
 Schlein, Robert George '72  
 Valcourt, Jean-Mary K. '85  
 NY G Baldwin, Alan Richard '70  
 Beckeman, William J. '79  
 Cornett, Dean Lee '71  
 Crompton, Kenneth H. '67  
 McKenney, John Lee '62  
 NY I Teleco, John Charles '69  
 NY K Ablowitz, Mark Jay '67  
 Alcaro, Domenic John '87  
 Brown, George Albert '48  
 Hinchaw, David John '86  
 NY A Fillo, John Paul '74  
 Silverman, Joel Stuart '74  
 NY M Hansen, Jean Marshall '77  
 Rest, George B. '75  
 NY N Darroch, Michael E. '84  
 Gluzak, Timothy John '88  
 Morris, George Craig '63  
 NY E Haller, Marc Frederick '85

- Mathews, Joseph R. '81  
Sanderson, Ellen Irene '81  
Steinle, Kathleen Susan '77  
NY O Venezia, Frank Bennett '90  
NY P Barber, R. Todd '87  
DeVoe, Charles George '76  
Drexel, Peter George '69  
Frank, Ian Joseph '09  
NY P Roldan, Mark Joseph '85  
NY T Torres, Peter '02  
NC A Alexander, Ralph Bell '76  
Baer, Richard Tobias '63  
Burkart, Alex Raymond '72  
Capps, Dickson Michael '75  
Daniels, Eric Andrew '85  
De Haas, Cynthia '91  
Hutcherson, Rodney N. '82  
MacHnik, Nicholas Jan '76  
Mitchell Jr., Glenwood J. '60  
Morton, Rodney Eugene '84  
Redano, Richard T. '78  
Shepherd, Steven Olin '94  
White, Samuel Ernest '69  
Wynegar, Kathleen M. '86  
NC F Ando, Robert Ryoichi '73  
Bullard, John Carson '47  
Chambers, William F. '60  
Hansen, Mikkel Anders '78  
NC A Hinkle, Mark Otis '96  
ND A Herbold, Frederick Jon '69  
Jacobson, John W. '69  
McLaughlin, Jenny L. '84  
Mittelsteadt, Steven J. '81  
ND B Dehen Jr., James John '80  
OH A Biery, Kurt Alan '85  
Brichford, Thomas K. '55  
Fernbacher, John M. '62  
Hamilton, Joshua J. '09  
Hecker, Siegfried S. '65  
Klimch, Kathleen Ann '90  
May, Ronald Alan '83  
Skaras, John '73  
Smialek, Jim L. '68  
Thro, Stuart W. '64  
Weddell, James Kenneth '76  
Zeis, John Frederick '62  
OH B Bobinger, Robert O. '69  
Dobashi, Harry Hideo '68  
Fazzoni, Gregory F. '76  
Hamilton, Edward L. '73  
Robinette, Lisa Marie '03  
Ruebusch, Robert J. '70  
Wood, Ronald Eugene '89  
OH G Au, Ralph Daniel '71  
Condit, Dale O. '66  
Edwards, Dale C. '61  
Edwards, William B. '71  
Hohman, Charles M. '67  
Hoover, Thomas Edwin '56  
Jester, Donald John '67  
Kirner-Pribe, Susan M. '85  
March, Michael Ross '85  
Marchlo, Keith Allen '02  
Mendelsohn, Richard H. '71  
Meredith, David B. '72  
Orkins, James E. '66  
Anonymous '86  
Robinette Jr., William '68  
Stumbaugh, Gary Allen '66  
Zeller, Hugh James '66  
OH A Brown III, Claude M. '74  
Felice, Conrad William '79  
Hild Jr., Wilbur Henry '64  
Miller, Truesdell Charles '64  
OH E Cull, Ronald Carl '70  
OH Z Allman, Susan Jane '85  
Babula, Maria '89  
Frederick, Wm G. D. '58  
Novak, Eugene Clark '59  
OH H Breuder, Andrew J. '70  
Clarke III, DeFrance '81  
Frass, Ronald Guy '78  
Hager, Douglas Scot '85  
Kohlhaas, Richard L. '62  
Leifeste, Sam Ernest '63  
Nelson, James Ralph '65  
OH O Doyle, James Thomas '65  
Kamowski, Dennis D. '73  
Rall, Richard Maurice '56  
Sink Jr., Robert Dean '87  
Walter, Kenneth Leo '63  
OH I Strausbaugh, Patrick D. '86  
OH K Duffy, Stephen Francis '78  
Maki, Luke Richard '78  
OH A Krueger, Karl Hermann '73  
Murphy, Charles James '77  
Suhar, Richard Allen '83  
OK A Lampl, Maurice Bernard '89  
OK F Basore, Paul Alan '78  
Dean, Philip Maxwell '74  
Freese, William Ernest '50  
OR A Beard, James Lewis '61  
Bishop, Donald Lee '65  
Jones, Reilly '75  
King, Warren Edward '69  
Marsa, Arnold Ray '49  
Penggely, David Douglas '78  
Sato, Ben '57  
OR B Buchanan, Marlowe J. '92  
PA A Barndt, Ronald LaMar '58  
Bradley Jr., Charles W. '51  
Fowler Jr., W. Beall '59  
Galella, Nancy Marie '85  
Granville Jr., Richard W. '55  
Hernjak, James Gregory '96  
Hjorth, Beverly Ellen '79  
Hopkins, Richard Henry '63  
Knorr, David Bruce '74  
Kroboth, Michael E. '72  
Parsons Jr., Donald F. '70  
†Saal, Frederick Alan '54  
Sherman, William J. '60  
Tahelm, Donald Lee '59  
PA B Best, William Joseph '80  
Ciuca, James Allen '72  
Cohen, Bruce Alan '72  
Dreibelbies, George A. '55  
Kolovsky Jr., John E. '92  
Magnus, John C. '48  
McGivern, Patrick John '90  
McNair Jr., Irving M. '54  
Solar, Ronald Jay '72  
Weston, Matthew W. '93  
PA G Chan, Allen Henry '82  
Helfer Jr., Arleigh P. '67  
Kuhr, Tina Michelle '81  
Riedel, Frederick W. '68  
PA A Epstein, Herbert '49  
Lewis, Timothy '64  
Sheker, Robert E. '91  
Sokal, Allen M. '68  
PA E Coffey, James M. '75  
Yoder, Paul Eugene '49  
PA Z Anderson, John A. '79  
Hunt, Steven David '80  
Kasoff, David '55  
Nadzadi, Mark E. '99  
†Ricci, Anthony G. '60  
Sarraf, Steven Scott '84  
PA H Boldt, Charles Martin '73  
Gilman, Thomas Carter '66  
Hills, Frederick James '61  
Hotchkiss, Jeffrey R. '69  
Reetz, Helen A. '78  
Swartz, William Ewing '54  
PA O Hilditch, John M. '83  
Latimer, Jose Ramon '77  
Volkay-Hilditch, Christine '83  
PA K Beseler, Jan W. '88  
PA A Reedy, Herman Earl '75  
Schurko, Robert John '78  
PR A Blasini, Francois Rene '82  
Hilerio Sanchez, Josuan '07  
Merceder, Marilia '82  
Sanchez, Hector Luis '76  
RI B Brady III, William James '80  
Oliva, Stephen Arthur '67  
Tetreault, David Edward '63  
SC A Alexander, Samuel D. '73  
Gray Jr., Blaine Edward '72  
Prothro, Joseph E. '63  
Scherer, John Harry '65  
Snider, Eric H. '75  
Speed, Penelope Ann '87  
SC B Allison, H. Barden '53  
Brady, Jeffery Ervin '85  
Feldmann, Andrew R. '89  
Harris, Raymond E. '87  
Lang, Christine Marie '80  
Walden, Gary R. '81  
SC G Baggett, Charlie C. '63  
Davis III, Emmett Irwin '79  
Gooley, Thomas Joseph '55  
Gustafson, Richard A. '63  
SD A McCourtie, Bonnie Rae '80  
SD B Bocklund, Lori Sue '83  
TN A Bowers, Robert Wesley '68  
Burnett, William Allen '71  
Chambers, George P. '58  
Ellis, Jeffrey Thomas '93  
Evans, Colby Russell '94  
Jackson, Karen E. '81  
Kaminsky, Lawrence V. '81  
King, Gregory Tyler '93  
Layman, Ronald Terry '77  
Miller, Freddy M. '79  
Peugeot, Richard Scott '60  
Shafer, Robert Weldon '47  
Sheffey, David Wells '66  
Totten, Barry Nelson '82  
Trundle, Max Don '72  
Ward, Joanne Schaich '81  
Welch, David Otis '60  
TN B Brown, George Arthur '55  
Brown, Kevin George '85  
Convery, Thomas P. '02  
Heflinger, Richard Scott '72  
Hodges Jr., Willie Erwin '67  
Petersen, Eric Scott '84  
Petersen, Stephanie A. '84  
TN G Badiru, Adedeji B. '79  
Britton, Thomas Carter '88  
Crawford Jr., Walter K. '62  
Steelman, James Taylor '71  
TN E Wilcox, Leslie M. '77  
TN Z Rethwilm, Craig R. '92  
TX A Cardwell, John Wesley '68  
Damek, Herman A. '97  
Dodge, Nathan B. '68  
Edgar, Arlan Lewis '57  
Glasow, Brian Scott '99  
Haschke, Chester Glen '50  
Kopecky, Johnny A. '65  
Kuenast, Walter Ulrich '78  
Le Bleu, Robin Boyce '65  
Lyle Jr., Fred F. '62  
Malins, Chester Joseph '76  
Marshall, James L. '72  
Matlock, John Hudson '67  
Meers, Steven Wayne '72  
Parma, George Francis '85  
Reese, Francis Edward '75  
Stanbery, Sam R. '64  
Sweet, Paul Alan '70  
Turner, William Danny '61  
White, Karen Leigh '84  
Whitesides Jr., John L. '65  
TX B Boyd, Suzanna Ruth '81  
Gilmer, Tracy F. '80  
Larkin, Rebecca J. '89  
Osborne, David Charles '61  
Rossler, Steven Wayne '73  
Stinson, John Michael '66  
Walter, Kevin Carl '88  
TX G Hunter, David George '79  
Johnson, Terry Robert '55  
Rachford Jr., Henry H. '45  
TX A Armstrong, Bryan M. '95  
Barger, David Carl '71  
Crosser, Robert Earl '50  
Dokos, Nick George '57  
Fink, Tami Neal '91  
Kasch, Vernon Ray '73  
Knowles, David Wayne '80  
Kunze, Glenn Ray '77  
Lam, Carroll Frank '58  
Linn, William Ray '81  
Madeley, Hulon M. '68  
Newton, Philip Lynn '57  
Pollock, Stephen T. '70  
Simpson, Stancy Jean '79  
Zimmerman, Keith D. '89  
TX E Bailey, Robert Richard '70  
Boone, Marcy Kaye '79  
Herrmann, Edwin Peter '67  
TX H Godwin, Albert Eugene '84  
Guinn, Douglas Edward '78  
Hoffman, Heather B. '92  
TX O Foster, Otis Charles '82  
TX A Alsop, Albert Walter '80  
Perez, Romeo Rene '82  
Rosenwald Jr., John A. '88  
UT A Dewey, William Alonzo '67  
Hull, Wade Alan '97  
Lamp, Jane Ann '80  
Peterson, Charles C. '68  
UT B Bingham, Kevin Duane '84  
VT B Berkman, Richard L. '69  
Dekalb, Shawn Wayne '85  
VA A Anderson, Willie C. '75  
Barrell, Charles D. '70  
DeYoung, John Howie '99  
Evans, Gary Kyle '77  
Garner, Patrick Lynn '72  
Ginader, Kenneth Lee '76  
Harris, Wesley Leroy '64  
MacKay-Smith Jr., A. '59  
Matthews, Nancy N. '81  
VA B Bronze, Thomas Peter '77  
Doughty, Gary Springer '77  
Long, David A. '91  
Motyka, Timothy John '78  
Nowotarski, Adam A. '91  
VA G Austin, Andrew Stone '89  
McGowan, David M. '89  
Wood, Travis B. '83  
VA A Payne Jr., Lewis F. '67  
WAA Draupp, John Albert '56  
Hulsizer, Stephen A. '69  
Orr, Peter Courtney '71  
Reichel, Jereal Dave '66  
Rising, Jerry Joseph '61  
Rosen, Donald George '58  
Sahakian, Zareh M. '81  
Smith, Jeffrey Francis '82  
Welsh, Bryan Douglas '87  
WAB Hartup Jr., John Dewey '50  
Hudspeth, James C. '88  
Langley, Duane D. '55  
Opfer, Neil David '76  
Washburn, Arthur King '67  
WAA A Campion, Paula JoAnne '00  
Yamaye, Zia Ahmad '77  
WVA Bibbee, Dennis Evans '75  
Fleischer, Charles John '70  
Gould, Marvin Burl '63  
WVB Raines, Linda N. '83  
Stevens, Ellen Weber '84  
Thornton, James R. '81  
WI A Buehring, William A. '67  
Guelker, Eric James '90  
Haas, Brian Lee '86  
Lutz, Leroy Albert '60  
Page, Chris Scott '90  
Sieker, Frederick A. '70  
Stickles, Kenneth '67  
Tellier, Ronald Robert '73  
Wellauer, John Charles '65  
Wulff, Kurt Henry '67  
Zemke, Wayne Philip '64  
WI B Grotelueschen, James H. '73  
Jaye, Deborah Ann '03  
McMorrow, Daniel P. '98  
Mooney, Thomas Joseph '79  
Swiontek, Thomas John '69  
Wick, Paula M. '81  
Wilhelmi, James Joseph '69  
WI G Jenn, David C. '75  
Simon, Karen Anne '83  
WYA Hand, Maureen '94  
Lester, Roger N. '87  
Scharton, Craig Allen '85  
**SECOND CENTURY CLUB**  
SPECMcDaniel, Patricia B.  
AL A Essing, John Earl '67  
Ponder Jr., Cecil A. '61  
AL B Moore, Ronald Allen '69  
Vickers, William Korth '88  
AL G Little, George Alan '81  
Sahawneh, Mary C. '76  
AL E Zozulin, Alexander J. '91  
AK A Darrow, Margaret Marie '02  
AZ A Leonardi, Suryanto F. '86  
Park, Trevor Howard '97  
AZ B Leftwich, Russell B. '74  
Takinen, Scott Alan '79  
AZ G Adler, James Robert '84  
Fellows Jr., Richard D. '85  
AR A Brady, Mark Jeffrey '83  
Williams, Curtis Ray '63  
CA A Griswold Jr., Thomas F. '72  
Holzer, Peter John '79  
Humphreys, George B. '51  
Pister, Karl Stark '45  
CA B Royden, Constance S. '80  
Sato, Kazuhiko '51  
CA G Bateman, Terry Spencer '58  
Clyne, Alisa Morriss '96  
Ellgas, Robert Alan '74  
Kwong, Michael Yiu-pun '95  
Lake, Carter Richardson '77  
Landers, Carl Francis '88  
Madden, Christopher J. '85  
Mitchell, Donald Beckley '59  
Nagel, John Frederick '91  
Rassieur, Robert Terry '79  
Richardson, John Lloyed '56  
CA A Goodin, James Douglas '57  
Hughes, Patrick James '80  
Koppany, Charles R. '63  
Lawson, William E. '62  
Nishimoto, Gregg Isaac '76  
Tan, Lim P. '78  
Yamashiro, Keith Kotsu '79  
CA E Bienstock, Bernard Joel '68  
Goodkin, Mitchell A. '68  
Kriger, Marc Yared '88  
Lepore, Robert Gerard '76  
Stein, Eugene P. '68  
Tipton, Howell Jack '61  
CA Z Beyers, Danny J.A. '15  
Egan, Thomas Vincent '88  
Masnada, Dante Angelo '75  
Overbey, John Kirkwood '77  
Sabbatini, Julian '68  
Sako, Mitchell E. '79  
CA H Bahr, Alfred Joseph '58  
Khalili, Azita M. '83  
CA O Bond, David Henry '68  
Carpenter, Victorina M. '07  
Gilman, Larry '73  
Hill, Jo Ann Lucy '87  
Hoekstra, Gerben N. '66  
Smith, John Mervin '70  
Tullock, Willard '76  
CA I Au, James T. '61  
CA K Kern, Jack Clayton '71  
CA A Johnston, Brian David '95  
Kiss, Robert David '85  
Miller, Richard Keith '71  
Sanicky, Susan M. '72  
Smith, Robert Press '75  
CAM Taylor, Michael S. '78  
CAN Amirhosseini, Michael '90  
Beardsley, Robert F. '71  
Caballero, Luis Alberto '85  
Chen, Peter Wai-Man '76  
Johnson, Michael Robert '86  
Mektrakarn, Wichian '86  
Michelson, Gregory J. '88  
Robertson, Alex Ann '03  
CA E Baxley, Paul Alma '81  
Nicoloff, Louise Therese '82  
Nicoloff, Nicholas '83  
Oneil, Patrick M. '82  
Patterson, Richard H. '74  
Schroeder, Steven A. '78  
CA P Barchichat, Emile N. '79  
Nakauchi, Edward M. '69  
CA P Alexander, Dean Lee '80  
Catamich, Steven Peter '83  
Costello, Vincent J. '08  
Hall, Mark Corwin '88  
Sullivan, C. Bart '86  
CA E Chambers, Guy Wayne '78  
CA Y Alexander, Joseph W. '06  
Alexander, Rachel K. '15  
Lindauer, John Arthur '90  
CA X Michaels, Philip George '91  
CO A Darling, Edwin Earl '68  
Devoe, Tracie Kay '82  
Gibbs, Frank Edward '84  
Miks, Kathryn Fink '87  
Peterson, Steven D. '72  
Swartz, Douglas William '82  
CO B Ashwood, Edward Ross '75  
Chapman, Terry Charles '69  
Cole Jr., Charles Owen '61  
Davis, Gregg Randal '77  
Greene, Christopher S. '73  
Neumann, Kenneth G. '50  
Sorensen, Chris David '79  
Valazquez, Jose F. '78  
CO A Ferentchak, James A. '77  
Mittelkauff, Stephen A. '09  
CO Z Crews, Mark Conrad '82  
CT A Bazun, Bradley Jay '80  
Eastman III, Frank H. '63  
Feinman, David Mayor '49  
Gerson, Gordon '58  
Lehman, Jill Elizabeth '81  
Ljung, Michael Allen '92  
CT B Dembieczak, Gerald J. '74  
Goldberg, Steven Barry '78  
Grossman, Richard L. '69  
Kramer, Steven M. '79  
Sobol III, Anthony J. '70  
Stanimunas II, Joseph W. '65  
Valerio, Clement V.A. '70  
DE A Bradley, Kevin Patrick '91  
Halfen Jr., Charles W. '80  
Maloney, Francis G. '73  
Seltzer, Kenneth E. '78  
DC A Amisial, Wilfrid Jean '71  
Hawkes, Mavis Beverley '77  
Sharpe, Irene White '63  
Wimberly, Mark Oliver '77  
DC B Burns, Richard Stephen '59  
Kosnik, Christine J. '95  
DC F Blackford, JP '95  
Laguarda, Leonard '79  
Whitham, Charles L. '61  
Wilhelm, Eugene Bailey '86  
FL A Carter, Hugo A. '79  
Hunt, James David '78  
James, Matthew Leslie '80  
Rauth, Terry Jean B. '77  
Reed, David Murdoch '82  
Schnitzler, Bruce G. '69  
Shelton, Mark Robert '80  
Tabot, Michael Thomas '71  
Tinsley, William Charles '77  
Vernetson, William G. '72  
FL G Anderson II, Shannon '75  
Miller, Joseph Raymond '73  
Paugh, Wayne Bruce '93  
FL A Bradshaw, Robert H. '77  
FL E Hansen, Christian M. '88  
FL Z Fricke, Steven Allen '93  
FL H Reinert, Richard D. '94  
FL O Leon, Felipe Antonio '99  
FL I Passarelli, Brian L. '10  
GA A Allen, Myron B. '58  
Dawdry, Jean Elizabeth '78  
Glover, Edmund Cook '60  
Horne, Carey John '70  
Leathers, James Crewe '81  
Lee, George Henry '70  
Lyons, Laura Christine '84  
Shurbutt, J. Steven '75  
Taylor Jr., George B. '75  
Tyler, Stephen M. '84  
Yarbrough, David Wylie '60  
GA B Jones, David Neal '92  
IL A Allen, Charles H. '66  
Buboltz, Lisa Ann '01  
Davis, Stephen Robert '63  
Dowden, Douglas '73  
Drolen, Bruce Lee '78  
Ellis, Paul David '66  
Gust, Lawrence Alan '93  
Hang, Kenneth Warren '66  
Hendron Jr., Alfred J. '59  
Herning, Joel Gregory '69  
Kareken, Ronald Samuel '57  
Kipp, Lyle Dean '86  
Kuhn, Paul A. '54  
Kuske Jr., John Anthony '61  
Lipinski, Paul Richard '60  
Madsen, Wayne Arthur '60  
Mikittka, Robert William '54  
Mueller, Vernon Charles '59  
Tuzelman, Byron W. '60  
Tonelli, Arthur Duane '57  
Wilhelm, Dale R. '80  
IL B Klems, George J. '58  
Knorovsky, Gerald A. '70  
Kufta, Richard Walter '77  
Lord, Mark Clyde '87  
Stocker, Danny Lee '86  
Thomas, Robert James '82  
Ziomek, Arkadiusz '10

- IL Γ Bickes Jr., Robert W. '63  
Cohler, Edmund Usher '49  
Derlacki, Walter R. '45  
Gosnell, John Reid '61  
Gubisch, Roland Werner '64  
Henze, Edward Durand '50  
Herman, Richard Neal '55  
Keables, Erin A. '84  
Ono, Craig Masao '81  
Rauh, Donald Albert '70  
Rivera, Angel Luis '80  
Sheppard Jr., Edward G. '63  
Wong, Thomas T. Y. '80  
Wright, Susan L. '74
- IL Δ Kobiella, Anthony R. '93  
Zapinski, Susan Marie '83
- IN A Alexander, John Albert '56  
Bach, Gary Robert '74  
Behr, Susan Rona '88  
Bottos, Beth Antonette '79  
Cappaso Jr., Vincent N. '54  
Cheesman, Mark W. '81  
Corns, Joseph Benjamin '52  
Cundiff Jr., Bruce T. '65  
Danner, David Lee '70  
Dries, David James A. '76  
Eveleigh, Virgil William '57  
Flanigan, David L. '66  
Forster, Allen Vaan '72  
Frazier, George E. '57  
Goette, William Edward '56  
Harding, Lisa Ann '81  
Hedegard, Alan Harold '64  
Heeren, Robert Gene '60  
Heintz, David Joseph '83  
Hibbard, George Lewis '65  
Holwager, Thomas '57  
Hounshell, William H. '65  
Jamieson, Leah H. '74  
Lee, Robert Edward '67  
Morgan, Rachel Diane '90  
Smigielski, Thomas S. '65  
Southam, Robert Earl '78  
Tucker, James Anthony '66  
Ward, John B. '58
- IN B Hovda, Keith Douglas '81  
Jones, Philip S. '56  
Mandeville, Tom '71  
Raff, Barry Edward '67  
Repp, Brent Thomas '88
- IN Γ Coolahan Jr., James E. '71  
Quarini, Mark L. '74  
Simons, Joseph L. '75  
Springer, Denis Eugene '67
- IN Δ Hessler, Glenn Brian '61  
IN E Nagielski, Lawrence S. '81  
IA A Bartlett, Roger James '64  
Covles, Harold A. '49  
Gaul, Alan David '83  
Hayes, John Oscar '66  
Houston, M. Dean '52  
Matheson, Harold M. '55  
Olson, Scott E. '69  
Owens, David Andrew '91  
Veenstra Jr., Henry R. '71
- IA B Fortney, Kathleen E. '92  
Priester, Henry Wyatt '83  
Stevens, Stephen A. '77
- KS A Bradley, Richard Leland '59  
Carvell, Lee Arthur '84  
Gerren, Donna Sue '90  
Meyer, John Edward '50  
Scamman, Franklin L. '66  
Struble, Philip William '79  
Tackman, Norbert Ellis '61  
Vijgen, Paul '87
- KY A Click, Randall Robert '00  
Gaffin, William O. '51  
Goertz, Jerry Walter '75  
Lockhart Jr., Zane D. '86  
Mullins, Chuck '87
- KY B Hughes, Earl C. '76  
Raderer, Thomas Kerry '73
- LA A Arman, Ara '55  
Chenevert, Edward L. '67  
Millar, John S. '68
- LA B Garrido, Louis A. '57  
Heausler, Thomas Polse '81
- LA Γ Gaiser, Les Keith '78  
Hogan, Harry A. '79  
Jenkins, James S. '80  
Jones Jr., G. Clifton '64  
Randall, James B. '79
- LA Δ Gannuch, Rodney J. '68  
Garber, James Daniel '66
- LA E Leonik, Krzysztof C. '91
- ME A Baker, Elaine '83  
Johnson, Philip Martin '55  
Jones Sr., Jeffrey A. '75  
Smith, Edwin Boardman '50
- MD A Catlin Jr., John Carey '69  
Gift, Elwood H. '54  
Hall, H. Thomas '56  
LaBerge, Chuck Charles '74  
Leimbach, Wendell Byrd '71  
Leith, Robert Stanley '51  
Piedrafito, Gary L. '78  
Sniegowski, James H. '78
- MD B Anonymous '77
- Galloway Jr., John P. '73  
Halvorsen, Fred H. '64  
Kalpas, Raymond A. '63  
Mitchell, Reginald H. '72  
Powell, John Irvin '71  
Taylor, Patrick Joseph '03  
Tracey, John Stanley '74
- MD Γ Lipscomb Jr., George A. '87  
Obstnik, Paul Edward '86
- MA A Ahern, Michael Francis '78  
Auclair, Jared Robert '01  
Mandle, Thomas Charles '76
- MA B Bangser Jr., William '48  
Braisted, Paul Evan '79  
Frassinelli, Guido J. '48  
Johnson, Timothy Lee '68  
Kendall, Robert Edward '50  
Margulis, John Reed '54  
Robinson, Thomas C. '58  
Schreiber, Robert Paul '75  
Seagle, John Peters '55  
Sheeld, Walter Milo '66  
Shepperd, Stan Wayne '70  
Smith, Kenneth Alan '58  
Tou, Frederick Nelson '81  
Walsh, Eamon Francis '03
- MA Δ Iovanna, Paul Robert '78  
Surtees, Robert Elliott '55
- MA E Boshart, Kenneth James '70  
Devney, Peter '89  
Fernald, Wayne Douglas '70  
Jurczyk, Thomas W. '71  
Keys Jr., Lloyd Shipley '70  
Levesque Jr., George E. '70  
Soulis, Wilbur Taggart '72  
Travers, Harvey C. '48
- MA Z Zarbo, Richard Mark '85
- MAH Magoffin, Michael A. '88
- MAΘ Moran, James Edward '83  
Vitale Jr., Anthony '86
- MI A Derby, Stephen George '69  
Fike, Jay Edward '96  
Golden Jr., August '66  
Heinmiller, Wayne R. '80  
Hills Sr., Richard Ervin '61  
Meckler, Carrie Lynn '98  
Nastas III, George '66  
Ruhl, Scott Alan '88  
Ruth, Gregory Philip '86  
†Ryckman, Jim James '88  
Salisz, Albert Andrew '75  
Su, William Perry '90
- MI B Hammar, Richard Harry '65  
Mansfield, Michael Guy '76  
Peck, John Hudson '68  
Pelletier, Douglas Peter '89  
Stone, David Garth '69  
Whitman, Brian Edward '92
- MI Γ Andersland, Mark S. '83  
Anderson, Richard W. '66  
Blair, David John '57  
Boettner, Donald W. '62  
Brown, Marshall Joel '96  
Duncan, T. Michael '75  
Elieff, Richard George '82  
Gniewek, Kenneth John '77  
Gross, Paul Henry '83  
Hickcox, Timothy Earl '65  
Holm, John Gustaf '89  
Lambert, Thomas Joffre '77  
Lipford, Rocque Edward '60  
Lugten, John Butterfield '76  
Margolese, Kate '84  
Miller, Richard Nelson '67  
Passman, Richard A. '44  
Rogne, Timothy James '78  
Scott, John Anthony '63  
Sherman, Larry Glenn '66  
Simmons, Richard W. '61  
Simons, Janet Lee '77  
Smith, Thomas Murray '72  
Stuart, John Kilgour '54  
Upham, Donald Lee '58  
Weber, Michael F. '78  
Winter, Steven D. '81  
Ye, Eric Thomas '84
- MI Δ Dauerer, Walter Peter '60  
Dubois, Kenneth R. '88  
Gallagher, James A. '68  
Kaunelis, Pranciiskus S. '69  
Lajeunesse, Robert Paul '74  
Marino, Joseph Anthony '72  
Randall, Godwin Paul '75
- MI E Billion, Stephan '08  
Mahanes Jr., Harold P. '65  
Mertz Jr., Harold J. '61  
Siepierski, Michael A. '80
- MI Z Gillham, Gregory V. '83  
Godfrey, James E. '48  
Lenz, Ronald Lee '81  
Riemann, Hans Gunter '73  
Wozniak, Curtis Steven '78
- MI H Cole Jr., James J. '78  
Polkinghorne, Bruce R. '50  
Webster III, James B. '79
- MI Θ Kaiser, Stephen Gerald '76  
Messer, Bryan James '98
- MI I Curry, Crystal Rae '83
- MNA Braaten, David Laverne '75
- Cavanagh, Stephen P. '89  
Larson, Michael Lane '59  
Olson, Daniel John '85  
Olson, Gary Elden '64  
Tran, Binh Van '89  
Waletzko, Nancy Ann '86
- MS A Barnett, Kerney Luther '71  
Blake, Charles Richard '69  
Corley, Katrina Lynn '89  
Dabney, Emily C. '88  
Davidson, John Howlett '90  
Gloppe, Elmer Theodore '75  
Steele Jr., W. Glenn '68  
Tyner, Fred Mack '93
- MO A Baker, Gerald Marion '63  
Fitzgibbons, Thomas J. '87  
Gardner, Roger William '63  
Gritz, Ludwig Adam '58  
Henderson, Betsy Lynn '84  
Lange, Stephen Joseph '85  
Malin, Robert Clayton '83  
Potter, Charles Jarrett '71  
Salerno, Michael Joseph '84  
Trefethen, Michael W. '70
- MO B Bach Jr., Wilbert E. '50  
Bodenhamer, Steven D. '75  
Broekhaus, Douglas A. '68  
Greco, Mary J. '84  
Hardebeck, Harry E. '57  
Kopsky Jr., Raymond J. '84  
Riley, Kenneth Gene '56  
Roam, John Harold '69  
Steinman, Rebecca Lee '96  
Stevens, Robert E. '85  
Vandergriff, Leland E. '71  
Wilreker, Victor Francis '72
- MO Γ Galbierz, Robert W. '64  
Klein, Milton '44  
Ladewig, Scott James '90  
Stephens, Mary E. '88
- MT A Jellison, Gabe Lee '98
- MT B Erickson, Elizabeth J. '93  
Jones, Sharon Alane '93
- NE A Fuchser, Fay Eugene '51  
Iwan, Russel Ray '81  
McMeen, Timothy M. '88  
Moore, Thomas Paul '78  
Paxton, William Glenn '87  
Schlautman, Mark Alvin '84
- NHA Bickford, Maurice D. '59  
Charron, Ronald Harvey '64
- NHB Price, Alexander Daniel '05
- NJ A Boardman, Thaddeus J. '52  
Chen, Kevin Emmanuel '06  
Elhrhardt, William C. '68  
Haid, David Augustus '57  
Reinhardt, Gregory C.J. '65  
Riccio, Robert Philip '70  
Tensfeldt, Thomas '81  
Tompetrini, Kenneth F. '65  
Wolosky, Irwin Stephen '68
- NJ B Andre, Gerald R. '75  
Brandenburg, Dan Saul '72  
Bubenick, David Virgil '73  
Feder, Gerald Lewis '86  
Palko, John Raymond '69  
Valk, Stephen B. '77  
Vosseller, Carol '80  
York, Brian J. '82
- NJ Γ Andrus, James '02  
Becker Jr., George W. '66  
Bornako, Gregory Louis '70  
Cordes, Robert G. '48  
Kobylarz, Thaddeus J. '58  
Labos, William Joseph '73  
McWilliams, John Paul '65  
Mulligan, Michael A. '80  
Reznak, Frederick John '69  
Scibilia, John '89  
Sulzberger, Carl L. '62  
Sulzberger, Virginia C. '62  
Telve, Toomas '64
- NJ Δ Aughenbaugh, Jason M. '01  
Bennett, Karl Edward '76  
Chen, Ephraim Jonathan '09  
Moore, Christopher C. '87  
Stern, Hal Lawrence '84
- NMA Aragon, Frank Garcia '77  
NMB Welfer, David Doyle '78
- NY A Blomberg, Richard D. '67  
Bucknor, Norman K. '84  
Lawson, Derek Michael '09  
Mullervy, John '00  
Paparis, Bill '75  
Repetti, Ronald Victor '57  
Richter, Stephen L. '63
- NY B Demyanovich, Sara E. '85  
Olson, John Frederick '64  
Rubinstein, Ian Z. '69  
Tobin, Michael R. '87
- NY Γ Antelman, Robert W. '73  
Brown Jr., Alfred W. '66  
Buttz, Charles William '56  
Covello, Joseph '63  
Dupier, Dennis George '61  
Foust Jr., Tilman H. '68  
Husmann, Donald '52  
Jennings, Robert Edgar '63  
Kotzalas, Nick '60
- Lenney, Robert Vincent '62  
Lewandowski, Michael '96  
Loewy, Robert Gustav '47  
Lyden, Michael Joseph '78  
Lynch, Michael Francis '87  
McAninch, Ian Matthew '02  
Natale, Michael Robert '02  
Timour, Sune E. V. '52  
Walter, Robert Wayne '64  
White, Andrew H. '71  
Williams IV, Carter N. '66
- NY Δ Elko, Michael Joseph '89  
Fricks, Eric Alan '87  
Gordon Jr., James P. '83  
Lampell, David Mark '73  
Ng, Benjamin '81  
Ramsdell, John Douglas '76  
Thomson Jr., James B. '68  
Waring, Michael Dana '65  
Wiley, David Robert '82
- NY E Jaasma, Edward George '59  
Mletzko, Alfred Emil '64  
Pinnes, Edward L. '71  
Wilson Jr., Ernest G. '66
- NY Z Seider, Warren D. '62
- NY H Baginski, Alfred John '62  
Filippi, Allan John '72  
Le, Phuong Dang '90  
McCLean, Jomo L. '92  
Wolf, Murray '48
- NY Θ Berlat, Norman Robert '62  
Franz, John William '70  
Free, Albert P. '78  
Lester, John Welch '52  
Marvin, Mayne Drew '80  
Schwind, Daniel Richard '76  
Stone, Robert Edward '76  
Wesler, Philip '48  
Young Jr., Lloyd W. '66  
Zagrobely Jr., Thadeus '76  
Ziki, Ann Louise '86
- NY I Charleson, Carl Richard '87  
Gallo, Anthony Michael '76  
Hauge, Kenneth '61  
Levy, Rami C. '92  
McCutcheon, William J. '66  
Philogene, Kenneth '81  
Ronan, Anne Elizabeth '83  
Weinberg, Aaron '69
- NY K Curtis, Johnson Ottawa '66  
Foote Jr., James Conklin '60  
Hutchings, Donald W. '61  
Isaacson, Morton S. '66  
Muller-Girard Jr., Otto '89
- NY A Braun, Bernard '65  
Ganetis, George Louis '78  
Monroe, Charles W. '53  
Passut, Charles Albert '67  
Taylor, Alwyn '75
- NYM Grant, Donald '91  
McCarthy Jr., James J. '66  
Wilcox, Robert E. '73
- NY N Davis, James Steven '70  
Havas, Donald William '67  
Kosmerl, Richard David '72  
Mann, Michael '77  
Pardini, Thomas John '77  
NY E Ball, Michael John '72  
Costello, Joseph John '70  
Defelice, Nicholas James '77  
Deierlein, Charles '82  
Frawley, Robert James '68  
Green, Gary Patrick '71  
Mercando, Anthony D. '76  
Miley, Kevin John '78  
Mohan, Anne Elizabeth '09  
Rodriguez, Ernesto '85
- NY O Jahelka, Joseph Robert '76  
Lamberg, Michael Jay '83
- NY Π Conzola, Vincent C. '88  
Howles, Douglas '76  
Richenderfer, Tommie G. '77  
Turner, Clayton Phillip '90
- NY P Hartmann, Martin R. '83  
Nerses, Annita '89
- NC A Baker, Fred Eugene '60  
Bishop, Ernest A. '73  
Galyon Jr., Luther Ellis '67  
Helms, Chester Ethane '74  
Keith, Alan Randall '82  
Starr, Hygie Irene '88  
Younts III, William E. '79
- NC Γ Block, Norman Gregory '54  
Farst, Douglas Edson '79  
Hustvedt, Kent Carlyle '75  
Moulton, Paul Rush '80  
Thor, Philip Wayne '74
- NC Δ Clark, Michael J. '75  
Dempsey, Gary Lee '82
- NC E Craft, William J. '63
- NDA Herther, Terry Dai '60  
Lopez, Angel '65  
Reifschneider, Paul H. '80  
Wiechmann, David Paul '85
- ND B Webster, Adam Lee '02
- OH A Allison, James Franklin '57  
Cares, William Ronald '63  
Drier, Delmar Waldemar '52  
Holloway, Walter Marion '67
- Honiou, Robert Todd '89  
Kirkland, Earl J. '75  
Kownacki, Edward J. '67  
Zurilla, Ronald William '61
- OH B Bulcher, Thomas J. '76  
Greene, Samuel Joseph '75  
Kojola, Scot Alan '95  
Lenz, Richard Ray '66  
Oliver, Fred William '65  
Rex, Clinton Owen '92  
Shields, John L. '75
- OH Γ Cory, Warren Eugene '76  
Del Tosto Jr., Joseph J. '87  
Del Tosto, Judith M. '87  
Frey, Mary Ellen '89  
Kohls, Thomas Carl '81  
Nodes, Scott Everett '84  
O'Neal, Joe Edward '55  
Sattler, Frank Joseph '62  
Verner, William James '58  
Weber, Robert Frederick '61
- OH Δ Hadley, Roger Adams '57
- OH E Bairoti, Janice Lynn '78  
Brandes, Thomas Alan '72  
Houston, Joel Edward '68  
Lemmers, Robert E. '82  
Nock, Jeffrey Edward '80
- OH Z Mowery, Thomas Troy '83  
Spicer, Alvin L. '67
- OH H Carlson, Lonnie '07  
Crowder Jr., George E. '77  
Haritos, George K. '69  
Hartman, Dean H. '99  
Menna, Richard Joseph '62  
Merkle, Laurence D. '92  
Wolfe, Stephen A. '85
- OH Θ Begovich, John Michael '74  
Centers, Robert Edward '70  
Crispino, David Joseph '80  
Kelly, John Bernard '67  
Mikalaukas, George A. '86  
Unverferth, R. S. '74
- OH K Bunnell, Robert Lee '76  
Casto, Terrence L. '69  
Volosen, John '77
- OH L Folk, Joseph William '98  
Selak, August John '79
- OHM Montgomery Jr., William '86
- OK A Andrews, Jennifer Diana '96  
Bastron, Victor Christian '66  
Brown, Leslie Wray '70  
Kleinsteiber, Stanley W. '78  
Shoebatham, Thomas B. '56
- OK B Harper, Lois Marie '86  
Petruska, Gregory James '80  
Weston, Kenneth C. '55
- OK Γ Lewis, William Jeffrey '84
- OR A Rupe, Robert Charles '72
- PA A Albright, Carl H. '65  
Branting, Katrina Louise '80  
Clegg Jr., Lee Milton '59  
Durdock, Robert Charles '57  
Haist, Randall Matthew '80  
PHELPS, David Reeves '62  
Ruth, Richard Lloyd '68  
Schatz, John Anthony '77  
Shuey, David Edwin '73  
Swartwout, John Baxter '73
- PA B Anderson, Ray Edwin '50  
Fetchen, John Howard '69  
Harvey, John William '95  
Irwin, Thomas John '70  
Kutz, Michael Ralson '88  
Mayers, Douglas L. '74  
Pock, Matthew P. '02  
Priesenheim, Timothy R. '90  
Ruth, Donald Lee '70  
Walker, Kurt Melvin '77  
Wanenchak, Michael J. '69
- PA Γ Carter II, Woodward C. '56  
Cooley, Wils Lahugh '64  
Costanza, Charles Peter '63  
Jourdain, John Michael '84  
Negri, Damon Joel '78  
Pierce, Amy Marie '80
- PA Δ Bartusiak, R. Donald '77  
Blecherman, Barry Seth '82  
Cavallaro, Joseph R. '81  
Chun, Ping Sun '62  
Turner, Michael Bryan '89
- PA E Flynn, Susan Mary '79  
Gentilucci, Joseph A. '53  
Haiber, Joseph Fowler '68  
Murgas, William Joseph '53  
Santo, William John '53  
Schenck, Arthur Jacob '73
- PA Z De Maio, Michael '76  
Jastrzembki, Joseph S. '64  
Patti, Francis John '50  
Thomas, Jeffrey R. '65
- PA H Brouse, Eric Logan '67  
Grier, Bruce Hood '77  
Pedersen, Neil Jon '74  
Stiger, David Laverne '83
- PA Θ Aschenbrenner, George '82  
Corradino, Joseph C. '65  
Griffin, Michael Vincent '74  
Lombardi, Charles G. '65  
McElhenny, James E. '70

PA I Eveler, Nathan Troy '07  
 PA K Potthoff, Robert E. '56  
 Siddiqui, Faruq M. '76  
 PA A Andes, John Arthur '82  
 Blackburn, Thomas A. '82  
 Fitzpatrick, Anthony R. '03  
 Heinrich, Christine D. '86  
 Kaplan, Kenneth J. '84  
 Kulik, David Benedict '83  
 Leiss, Wayne Guy '76  
 PR A Brana-Mulero, Francisco '74  
 Negron Rivera, Dennis '13  
 Novomestky, Frederick '69  
 Perez, Luis A. '88  
 RI A Campbell, Neal Stone '68  
 Chorney, Paul '56  
 Olding, Duncan Robert '55  
 RI B Bershtein, Margaret '85  
 James, Charles Franklin '58  
 Lebeau, Andrew Joseph '79  
 Mastrostefano, Vincent '75  
 Silva, Ronald Ernest '74  
 Sirois, Herbert Joseph '71  
 SC A Harley, John Price '78  
 Stecker, Marc Kevin '82  
 Wayne, Hugh Swinton '49  
 SC B Hilday, Charlene Marie '96  
 Lesto, Kenneth Reed '53  
 Segui, William Thornton '60  
 Veldman, Stephen Todd '98  
 SC F Bolden, Michael Vincent '97  
 Langston, Ronald E. '64  
 Lindsay, Craig Thomas '86  
 SD A Beck, Carl William '83  
 Bier, James John '84  
 Eizember, Thomas R. '76  
 Kerk, Carter J. '81  
 Zehring, Roderick Scott '94  
 TN A Bowden, Bryant Baird '68  
 Burka, John Morgan '49  
 Cavender, James Milton '66  
 Conway, Tammy Kay '82  
 Exum, Joe Hardman '52  
 Harrison, Christina M. '93  
 Holmes, Winston H. '85  
 Icove, David Jay '71  
 Jenkins, Alvin Leigh '61  
 Long, William Pock '69  
 Oliver, Edward Earl '66  
 Rogers, Marvin Dale '70  
 Sewell, John Ike '54  
 Tang, Alice Hsuanchen '86  
 Tarrant, Charles H. '57  
 Taylor, David Richard '69  
 Williamson, James Moore '79  
 TN B Campbell Jr., Henry G. '59  
 Cummings, Becky G. '76  
 Hawkins, Kenneth E. '88  
 Lyle, Stephen Michael '79  
 Shireman, John F. '76  
 TN F Clevenger, Jerry A. '65  
 Haile, Robert John '94  
 Howey, James Edwin '68  
 Murphy, Fred Anthony '71  
 Pedigo, Donald Bruce '83  
 TN A Halsema, Paul Bernard '81  
 Luttmann, Lisa M. '82  
 Luttmann, Mark Joseph '87  
 TN Z Wilson, Matthew William '00  
 TX A Badgwell, Thomas Alan '92  
 Boyle, Bruce William '79  
 Crippen, Robert L. '60  
 Floyd, F. Mike '63  
 Givens, Kent Barr '72  
 Huggler, Bodin Anthony '56  
 Luevano Jr., Richard '83  
 Machedahl Jr., C. Albert '57  
 Parent, Laurence E. '81  
 TX B Albritton, Patrick M. '96  
 Baker Jr., Marvin Elroy '86  
 Boyd, Joseph Gregory '76  
 Gates, Robert Douglass '72  
 TX F Flatt, Robert Neal '69  
 O'Gwynn, David Charles '78  
 Turner, James Ward '76  
 TX A Barksdale, Donald Lee '55  
 Boedecker, Tom Jay '64  
 Caffey, James Enoch '55  
 Caso, Gregory Scott '87  
 Chaput, Armand Joseph '63  
 Cox, Ralph Frank '54  
 Crews, James Alvin '58  
 Franke III, Henry G. '77  
 Johnson, Vance Clay '78  
 Jordan, Kirk Gerald '80  
 Massett, Donald Allen '70  
 McCord, Jimmy Delwyn '70  
 Miesen Jr., Robert John '87  
 Murthy, Prahlad N. '92  
 Schroeder, Scot Alan '81  
 Schwierke Jr., Perry J. '60  
 Wornat, Richard Oscar '49  
 Wright, Charles Eugene '62  
 TX Z Mars Jr., James Floyd '72  
 TX H Brewster, William H. '94  
 Loper, Thomas Lee '81  
 McBay, Michael R. '73  
 Norwood Jr., Edwin B. '67  
 Tepper, John C. '82  
 Witt III, Arthur William '88  
 TX O Garcia, Robert L. '79  
 Van Reet, Leo Joseph '70  
 TX I Maguire, Daniel Myron '81  
 Merrett, N. Rhys '77  
 TX K Jolley, Lawyer Curtis '79  
 TX A Wallace, Weldon Lee '74  
 UT A Ferguson, Brian D. '80  
 Jarrell, Reese Patkin '79  
 Soss, David Albert '71  
 UT B Craig, Donald Dean '82  
 DeCarlo, Armondo '95  
 Dickson, Lloyd Brent '63  
 Hardy, Mark Douglas '84  
 Hart, Robert Evan '73  
 Hinman, Paul Victor '71  
 Thompson, James R. '76  
 UT F Esplin, Robert Barton '04  
 VT A Cook, Barbara Karen '84  
 Egner Jr., J. David '79  
 Goddard, Eric Hapenny '86  
 Shatz, Jonathan Ary '82  
 VT B Clark, David Thomas '81  
 Henry, Thomas Arthur '70  
 VA A Ashton, Michael Duane '74  
 Byers, Duane Michael '80  
 Capon, Robert Stephen '80  
 Coleman, George W. '45  
 Colonna, James Lewis '65  
 Jacobs, Susan Broadadd '85  
 Johnson-Payton, Lori R. '97  
 Jokl, James Anthony '80  
 Kiss, Linda D. '85  
 Lanford Jr., Stanard F. '55  
 Ring, Jesse Bane '69  
 Sussman, Theodore D. '81  
 Wyant III, Thomas R. '71  
 VA B Barnes, Edgar Eugene '68  
 Blanton, John C. '76  
 Dalton Jr., Eddie Gene '86  
 Davidson Jr., Charles A. '70  
 Gresham, James Arthur '83  
 Kern, David Paul '98  
 Meith, Robert M. '57  
 Michelson, Darlene Sue '86  
 Parker Jr., Mavor L. '56  
 Ray II, Robert E. L. '74  
 Sloan, Forrest E. '83  
 Wayne, Jennifer Susan '83  
 VA F Lashomb, Susan Marie '83  
 Rausch, Leonard Earl '80  
 VA A Bunch Jr., Jennings B. '50  
 Carr, Dale Allen '77  
 WAA Bullock, Dennis Eugene '76  
 Chou, Chung-Kwang '75  
 Davis, Beverly Ziegler '80  
 Levin, Marc E. '80  
 Miller, Stefan John '63  
 Purdy, Catherine P. '72  
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 Karr, Ken Richard '63  
 McCain, Julie Albers '96  
 LA A Blum, Joseph Francis '65  
 Davis, Stephen Drake '79  
 Hicks, Richard Wayne '62  
 Hutchinson, Jeffrey T. '68  
 Lafleur, Stephen Alan '75  
 Rollo, Anita H. '60  
 LA B Maute, John Kinsman '81  
 Quarve, Eric Bryce '94  
 LA G Ezell, George Dale '60  
 Greco Jr., Carl '67  
 LA A Costa, Eduardo C. '60  
 Dugas, Caffery James '77  
 Randazzo, Bert J. '92  
 LA E Dilberto, Marcella D. '03  
 Gardner, Chris Sidney '91  
 ME A Dunlop, Raymond D. '60  
 Evenson, Paul Roald '85  
 Furrows, Stanley D. '56  
 Gill, Thomas Alexander '84  
 Perham, Douglas Alan '62  
 Ray, Robert Andrew '65  
 Smith, Craig Hamilton '80  
 Verrill, Christopher Lee '85  
 MD A Dexter, Frederick J. '74  
 Syed, Ishaq Yusuf '00  
 Ulanowicz, Robert E. '64  
 Williams, Cyril Labode '97  
 MD B Baer, Michael '69  
 Donigian, Carl Drafts '78  
 Flewelling, Arthur S. '69  
 Mauck, Ray Allen '67  
 Scurlock Jr., Arch C. '69  
 Weinbach, Jennifer Cope '84  
 Zinkgraf, George H. '73  
 MD G Scioi, Blaise E. '84  
 MD A Rothman, Neil S. '78  
 MD E Earley, Jonathan Alex '07  
 Smith, Andre St. Clare '03  
 MA A Buffi, James Anthony '77  
 Hoffman, Allen Herbert '63  
 Melanson, Vanessa Rose '01  
 Mott, Tyler James '15  
 Skliutas, John Paul '79  
 Szymkiewicz, Paul Mario '93  
 MA B Calvano, Charles Natale '70  
 Gootenberg, Jonathan S. '13  
 Hsu, Kay Lynn '91  
 Nathanson, Josef '63  
 Schwartz, Russell S. '95  
 Stallard, David Varner '49  
 Thompson, Hugh A. '62  
 MA A Bryant, David Alan '66  
 Fogel, Ariene Beck '77  
 Halberg, Walter '60  
 Heller, Ethan B. '07  
 Sorgi, Aladino D. '61  
 Weinstein, Herbert G. '61  
 MA E Blecha, Mark Alan '85  
 Gadon, Charles Bennett '80  
 O'Leary, Raymond Paul '74  
 Tsang, On K. '06  
 Tyson, Rich P. '83  
 Vallee, Joy Marie '83  
 MA Z Blackmer, Randall Gale '52  
 Richardson, Alan M L '70  
 MA H Shapira, Yoav '99  
 MA A Aste, Stephen Robert '99  
 Cote Jr., William Lucien '87  
 Dusenberry, Matthew S. '10  
 Hamilton, Ray '16  
 Marchese, Paul S. '89  
 Vasilos, Thomas '50  
 MI A Berg, Dale Evan '67  
 Berger, Thomas C. '87  
 Gorman, Kurt David '76  
 Pettrille, Dennis G. '62  
 Potvin, Deborah L. '91  
 Vannice, Merlin Albert '64  
 MI B Abplanalp, Laura '82  
 Burnette, Keith Thomas '64  
 Eldridge, John Lennox '84  
 Hupy, Craig Allan '83  
 Simpson, Stuart P. '59  
 MI G Brandenburg, David W. '68  
 Bulleri, Andrew A. '60  
 Fancher, Paul Strimple '53  
 Johnson, Eric Raymond '75  
 LeVine, David Michael '63  
 Locooco, Louis Robert '69  
 Lucyshyn, Peter S. '56  
 Milburn, Darrell Alan '67  
 Plecha, David A. '83  
 Plecha, Gayle Eileen '83  
 Rhines, Walden Clark '68  
 Robben, Richard Walter '74  
 Sanabria, David A. '90  
 Sherman, Steven R. '92  
 Sklar, Jay Robbins '60  
 Sterngold, Henry '43  
 MI A Dupuis, Michael Charles '11  
 †Hoban, Thomas William '60  
 Stark, Daniel Joseph '74  
 Ziemba, Gerald Paul '57  
 MI E Diccico, Dominic Mario '93  
 Lemanski, Preston J. '14  
 Nkanga, Iniabasi E. '08  
 MI Z Inman, Jeffrey J. '79  
 Kanaby, Kenneth Dale '73  
 Reuter, David Fredrick '73  
 MI H Cook, Kenneth John '64  
 Lindeman, William John '92  
 MI I Sok, Ethan '10  
 MI K VanZweden, Daniel J. '18  
 MNA Eastman, Timothy Eric '67  
 Lemke, John David '88  
 Oberg, Arthur John '51  
 MS A Cleveland, William P. '10  
 Heintz, Sarah Marie '13  
 Ownbey, Karen Marie '88  
 Rogers, Steven Matthew '85  
 Scruggs, Fred Matthews '62  
 Waters Jr., William F. '66  
 MS B Echols, John Alford '67  
 MO A Bade, Darrell Dean '73  
 Weber, Arthur Rudolph '47  
 MO B Hitt, Gerald Wayne '69  
 Jackson, Wayne Donald '52  
 Kern, John H. '60  
 Otten, Peter Ernesto '62  
 Schafer, Robert Philip '52  
 Stegemeier, Richard J. '50  
 MO G Burms, Steven Michael '81  
 Fleschner, William L. '67  
 Koester, Donald R. '52  
 Peters, Christopher J. '09  
 Schmitt, Mark Alan '93  
 MO A Blacett, John '92  
 MO E He, Chang '14  
 MT A Bohac, Charles E. '69  
 Hart, William Frank '67  
 MT B O'Dell, Brian Joseph '82  
 NHA Becker, George Robert '65  
 Hutchins, C. Kenneth '53  
 Killam, Dean B. '73  
 NJ A Buca, Stephen John '86  
 Eisenberg, Matthew '69  
 Goller, Karl Richard '52  
 Smith, Stanley George '53  
 NJ B Lynch, John Francis '77  
 Russell, Kenneth Alfred '65  
 NJ G Canter, Jeffrey B. '95  
 Catalan, Jose Artemio J '96  
 De Rossi, Vincent John '90  
 Dell, John Joseph '56  
 Ferruzza, David '58  
 Gomez Jr., Ernest '71  
 Kleskovic, Peter Zdenek '74  
 Peckham, Christopher '87  
 Pham, Phong Ngoc Anh '10  
 Pisz, Frank Andrew '71  
 Sopko Jr., John Joseph '64  
 Stanko, Roger John '72  
 NJ A Mann, Ronald Lawrence '76  
 Seitman, David Todd '74  
 Sierchio, James Gerald '72  
 NMA McCreedy, Kem E. '80  
 Pines, Edward '79  
 Subia Jr., Samuel R. '81  
 NY A Altmann, Howard W. '73  
 Herman, Mark Norman '63  
 Morrison, Jeffrey Steven '68  
 Thatcher, M. Llewellyn '59  
 Van Keulen, Maria '16  
 NY B Chamberlain, Steven C. '68  
 Johnson, Gilbert '66  
 Jones, Harold F. '56  
 Keiffer, Robert Lloyd '73  
 Sahn III, William H. '64  
 NY G Barbash, William A. '55  
 Crouse, Edward Michael '86  
 Guild Jr., George S. '67  
 Hidalgo, Fausto Gaston '44  
 Kehoe, Timothy Wayne '83  
 Savrick, Martin '60  
 Trolle, John Charles '66  
 Weinstein, David '08  
 NY A Dumouchel, Matthew P. '08  
 Gordon, Susanna P. '87  
 Hughes, William Morris '82  
 Ku, Katharine '71  
 Ristas, Lombro James '71  
 Russell Jr., Robert H. '49  
 Schwartz, Ricky Glen '78  
 Sheppard, Charles W. '67  
 NY E Brolin, Stephen Joseph '57  
 Leonard, Donald John '56  
 Litofsky, Barry '62  
 Mennerich, Kenneth A. '65  
 NY Z Hosken, Robert W. '61  
 NY H Grecco, Nicholas J. '69  
 Henry, Michael Kernen '10  
 Kane, Ronald Steven '65  
 Ortiz, Pablo Javier '66  
 Pedersen, John F. '69  
 Sandler, Stanley Irving '62  
 Wasserzug, Louis '83  
 NY O Henschel, James Paul '73  
 Jersabeck, Valerie B. '76  
 Schepis, Randy Scott '83  
 Seger, Edward Samuel '78  
 Smith, Bakari Imaan '17  
 Stubbs, David Rowland '61  
 Watson, Richard Paul '78  
 NY I Kramer, Gordon '59  
 Mardler, Alan Mark '71  
 Nelson, Ivan '60  
 Zacharias, Alfred '53  
 NY A Traina, Edward P. '62  
 NY N Alexandridis, Paschalis '89  
 Coates, Donald Andrew '64  
 Guildford, Harry J. '52  
 McCullough, Earl S. '63  
 Soderholm, Gordon M. '07  
 NY E Hummel, George B. '62  
 Spinazzo, Frank John '04  
 NY O Blumrich, Mattias A. '86  
 Imbrogno, Christina '14  
 Imbrogno, Joseph M. '12  
 Kannan, Sandhya '17  
 NY P Szybit, Thomas A. '88  
 NY P Carillion, Geraldine K. '86  
 Yurman, Joseph L. '87  
 NY Z McCauley, James W. '61  
 NY T Lui, Jennifer '13  
 NC A Auerweck, Richard L. '90  
 Fales Jr., Carl Lynwood '61  
 Hendrickson, Robert G. '66  
 Hine, David Eugene '80  
 Prettyman, Thomas H. '90  
 Stevenson, James F. '62  
 NC G Midkiff, Scott Fugate '79  
 NC A Austin Jr., Billy Willis '86  
 Towery, Caroline '00  
 ND A King, Robert Donald '63  
 Offerdahl, Richard '65  
 Sauber, James George '58  
 Wandersee, Dale Alfred '67  
 OH A Andersen, Kayla Brooke '17  
 Delanis, Richard John '72  
 Widmer, Mark Thomas '84  
 OH B Jenkins, Kyle D. '16  
 Korner, David Scott '73  
 Nathan, David Levi '87  
 Proakis, John '59  
 Rouse, James Alan '58  
 OH G Armand, Joseph Marc '14  
 Captor, R. Nick '81  
 Hall, Susan Elizabeth '84  
 Likavec, Michael T. '00  
 Neal, Richard L. '64  
 Vinarek, Michael John '90  
 Wigginton, Mark Allen '80  
 Williams, Robert Lloyd '60  
 Ziebro, Tom Richard '16  
 OH A Kline, Patrick Joseph '73  
 OH E Contofalsky, Douglas E. '77  
 Oyster, John Matthew '08  
 Sturik, Tom S. '85  
 Tillie, Chuck F. '12  
 OH Z Walker, Edward Philip '74  
 OH H Cross, Stephen Edward '77  
 Fox, Gordon William '63  
 Heil, Michael Lloyd '86  
 Kelley, Gilbert Freeman '60  
 Wier, Ray C. '96  
 OH O Bouchard, Michael P. '81  
 OH I Rowland, Benjamin C. '06  
 Rowland, Sarah L. '06  
 Tomkins, Robert G. '61  
 OH K England, Richard L. '73  
 Jennings, Alan Lance '06  
 Ruggles, Harold Thomas '84  
 OH A Hosseimejad, Bijan '06  
 Reedy, William John '84  
 OH M Moore, Leah Beth '10  
 OH E Graessle, Robert James '08  
 OK A Johnson, Melanie Diane '00  
 Robbins III, George E. '74  
 OK B Golick, John Paul '78  
 Meier, Mark Albert '82  
 Wyatt, Kay Louise '76  
 OK G Clark III, Robert Allan '10  
 Goodin II, J. Riley '80  
 OR A Lindahl Jr., Ernest R. '73  
 McElmurry, Barry R. '59  
 OR G Zhang, Ziyuan '08  
 PA A Carnali, Joseph O. '78  
 Carnali, Leslie '78  
 Doty, Robert Kenneth '68  
 Dreyer, Darlene Anne '97  
 Lamparter, Robert W. '72  
 Long, Hal Alan '69  
 Soell, Julian Richard '91  
 Waite Jr., Robert F. '91  
 Walsh, Christopher D. '88  
 Weiss, William Lewis '58  
 PA B Babcock, Daniel L. '52  
 Brookhart, Michael Ellis '82  
 Getz, David Allen '79  
 Gray, Kevin Troy '85  
 Hurley, Francis X. '63  
 Kalasheh, Amir Samuel '09  
 Thompson, Hunter W. '17  
 Trautz, Todd Joseph '07  
 Williams, Russell C. '75  
 Willis Jr., Max Stephan '53  
 PA G Atkins, Robert Steven '69  
 Krouskop, Andrew C. '73  
 Menzies, Katherine L. '08  
 Scocozzo, Nicholas J. '06  
 Seaverson, Erin R. '00  
 PA A Boalick, Scott Russell '87  
 Cohen, Matthew Leon '10  
 DeNunzio, Andrea Gayle '05  
 Vrudhula, Aamey '17  
 PA E Inqui, Dena D. '13  
 Kazda, Joseph Stanley '75  
 PA Z Freed, Robert Lloyd '73  
 Gregory, Richard S. '65  
 Jauntirans, Juris '62  
 Laukaitis, John Frank '50  
 Misiewicz Jr., Raymond '79  
 PA H Buczynski, Robert John '61  
 Cook, David Michael '04  
 Guy, Wayne Mark '69  
 Hertz, Robert Goldberg '50  
 Hine, Laurel Anne '08  
 Mighell, Edwin R. '52  
 Skiff, John F. '56  
 Toole, T. '83  
 PA O Cocchetto, Alan M. '83  
 Czop, Walter J. '86  
 McMerty, Edward A. '57  
 Morrison, Alan E. '69  
 Mullee, William A. '54  
 Sabanayagam, S. '88  
 PA I Dao, Paul Ngoc '94  
 PA K Mangelsdorf, Frederick '53  
 PA A Sawyer Jr., Stephen G. '98  
 PR A Arias Rosado, Jose M. '11  
 RI B Berube, Richard Henry '62  
 Bradley, Ken Alan '81  
 Caranci, Manfred L. '72  
 Di Spirito, Karen Marie '87  
 Mankame, Anil '97  
 SC A Elrod, William Corbin '49  
 SC B Simontis, Nicholas R. '00  
 SC G Beach, Emerson Lee '84  
 Burns, James A. '60  
 Cook, Dallin John '17  
 Forcier, John David '72  
 Guaiqua, Mike Vicente '13  
 Mueller, Peter Walther '82  
 SD A Anderson, Roger A. '79  
 Anderson, Sandra Kay '79  
 Jorgenson, Philip C.E. '80  
 SD B Konda, Travis Frank '98  
 TN A Baxter, Van David '75  
 Beall Jr., Samuel E. '42  
 Brewer, James Herbert '58  
 Bryan, Catherine Burns '84  
 Connelly, Joseph Alvin '64  
 Dunn, Robert Emmett '73  
 Griffith, Linuel Hoyt '57  
 Neville, Randall Lee '75  
 Olberding, Terry D. '78  
 Smith, Robert Kenneth '63  
 Wall Jr., William Alfred '50  
 Williams, Kathy Ann '85  
 TN B Horn, Lawrence H. '48  
 Myles, Jennifer Lee '94  
 Nolan, Martin Richard '69  
 Smith, Robert Horton '65  
 TN G Carrington, Marjorie '77  
 Chandler Jr., Charles A. '58  
 Clark, Larry Rhyter '67  
 Hall, Spencer Earle '69  
 Hamby, James A. '69  
 Jennings, Matt Matthew '17  
 TN A McGinnis III, Trey E. '17  
 TN E Sweigard, Rick J. '75  
 Thomson, Matt N. '80  
 TN Z Miller, Andrew C. '12  
 TX A Berezovytch, William N. '67  
 Bruce Jr., William T. '62  
 Castiglione, Paul Alfred '70  
 Dressler, Amber Dawn '16  
 Mahla, Curtis Harry '52  
 Morrow, Jack D. '72  
 Schwartz, Nicole S. '06  
 TX B Winder, Charles F. '12  
 TX G Dobbin, Douglas George '83  
 Grueneich, Grant R. '65  
 TX A Anthony, Rayford G. '58  
 Bevens, Gordon Edgar '68  
 Bounds, David Carlyle '58  
 Bowen Sr., Jerry F. '56  
 Brunkan, Bruce James '78  
 Ginson, Gayle June '83  
 Lange, Lawrence K. '60  
 McClung, David Allen '73  
 Pate Jr., Alfred R. '60  
 Pensock Jr., Edward P. '83  
 Rudd, Weldon Eugene '59  
 Schumacher, Daniel M. '89  
 Snauffer, Mark Jeffrey '87  
 Ward, Jack Lee '48  
 Waugh, Michael Scott '79  
 TX E Coneway Jr., Rick '73  
 Lim, Zuan-Fu '15  
 Moreland, Gerald T. '70  
 Roxburgh, Charles D. '62  
 TX Z Bean, Doyle P. '80  
 TX H Bhatt, Tanay Mahendra '05  
 Hartman, Kenneth W. '97  
 Hartwig, Roger Earl '78  
 Libebee, Christian B. '15  
 Neogi, Smriti '12  
 TX O Lovelady, James Tracy '90  
 Serna, Jesus Rodolfo '72  
 TX A Garza, Daniel Rey '07  
 Luera, Luther G. '75  
 Perez Jr., David '01  
 UT B Bracken, Allen T. '78  
 Fredrickson, Russell B. '01  
 Tullis, Richard Lamond '84  
 VT A Aldrich, Bradley Frank '81  
 Su, Flora Kathleen '15  
 White, Janine L. '03  
 VT B Braz, Kevin Anthony '87  
 Cevalher, Charles E. '52  
 Rizzi, Walter Joseph '59  
 VA A LeBeau, Ray Paul '90  
 Owen, William Rodney '69  
 Painter, James Walter '68  
 Reid, Robert Erskine '64  
 Rosen, Mitchell Charles '82  
 VA B Frieman, Robert Philip '61  
 Gonsalves, Jose Thiago '16  
 Harvie, Erica Jayne '13  
 Humphries Jr., William '69  
 May, William H. '64  
 Powell Jr., Robert C. '13  
 Sproles, David Alton '77  
 Sroka, Kristin Elaine '02  
 VA F Peters, Mary Edwards '81  
 Reaves, Eric Rafael '18  
 Volos, Haris '04  
 VA A Brinkley, Anthony L. '92  
 Radford Jr., Norman D. '65  
 WAA Evans, Michael Leston '77  
 Foster, Malena Louise '06  
 Gorcek, Francis D. '70  
 Sabado, Maurice M. '75  
 WAB Baxter, Donald Wallace '74  
 Beach, Paul Gary '65  
 Veenhuizen, Scott '66  
 WAA Daquisto, John Fred '65  
 WVA Chippis, Clay Thomas '17  
 Hilton, Ernest William '78  
 Kopyar, Eugene Fred '56  
 Reed, Glenn Thomas '70  
 WVB Sozinho, Felipe '16  
 Strada, John Thomas '69  
 WI A Betts, Anthony Michael '13  
 Beuscher, Hugh '59  
 Binning, Robert Calvin '51  
 Chesner, Ramon '58  
 Dillinger, James Roland '68  
 Ehrmann, Thomas W. '56  
 Schmidt, Paul A. '77  
 Webster, James L. '72  
 WI B Lazachek, Gary Walter '65  
 Quinn, Robert J. '74  
 Sytkowski, David G. '82  
 WI G Dunn, Jeffrey William '81  
 WI E Biddick, David James '05  
 WYA Larson, Lisa Jean '01  
 Woicik, Jacob Stewart '16



## IN THE COLLEGES

### SPOTLIGHT

#### Engineering Medicine

A leading biomedical engineer has stressed the need for a collaborative approach to training engineers and medical professionals.

In an article for *The Conversation*, University of Virginia professor **Jeffrey W. Holmes, M.D.**,



Ph.D., *Maryland Alpha '89*, wrote about the many innovations that have “emerged at the interface of engineering and medicine. In an era of big data,

personalized medicine and artificial intelligence, the importance of engineering, especially in medicine, is increasing.

“In my own field of cardiovascular bioengineering, engineers now routinely build and run sophisticated, patient-specific computer models of blood flow in just a few hours, helping doctors diagnose and treat heart disease.”

Holmes described the work of engineering schools to prepare future biomedical engineers, but lamented a lack of training in med schools to “help physicians develop a complementary skill set... Several medical schools have recognized the need for engineering-literate physicians, building new campuses and launching new programs that blend medical and engineering education. Yet, many of these efforts are employing an outdated, physician-centric model that envisions training one person in two disciplines, rather than preparing them to collaborate in multidisciplinary teams.”

Holmes called for “a new approach: a proven, scalable approach at the engineering-medicine interface that teaches engineers and healthcare professionals to work together in teams.”

#### Tech Giants Take AI Teachers

AI scholars are increasingly shifting from the education world to the lucrative tech giant world where they are applying their expertise, reported *Bloomberg Business*.

The magazine cited a school of engineering and computer science, “one of the finest in the U.S.,” as been among the hardest hit. It said eight out of 11 faculty members working in “robotics, machine learning and natural-language processing were currently on leave, or spending at least 50% of their time at Amazon, Facebook Inc., Apple Inc., Nvidia Corp., D.E. Shaw & Co. and the Allen Institute for AI.”

Bloomberg asked the question, “If industry keeps hiring the cutting-edge scholars, who will train the next generation of innovators?”

#### A Matter of Degree!

*Harvard Business Review's* annual ranking of top-performing CEOs around the globe found that engineering degrees are slightly more prevalent among these top corner office occupants than the finance- and strategy-focused MBA.

It said this trend could reflect strong performance among tech-driven CEOs but also a possible openness to engineering among a wider range of companies.

Thirty-four of the top 100 CEOs in 2018, according to the *HBR* report, had an engineering degree, compared with 32 who had an MBA. Eight of the top CEOs had both degrees. In 2017, some 29 CEOs had MBAs and 32 had engineering degrees, the first time that there were fewer MBAs than engineers since 2014, when it began tracking the degree question.

### PEOPLE

**Irma M. Becerra, Ph.D.**, *Florida Beta '82*, has become the seventh president of Marymount University.

She was previously the provost and chief academic officer at St. Thomas



University after serving at Florida International University for almost three decades, including as a professor in management information systems and later

as entrepreneurship center director, vice provost, and vice president. Becerra founded FIU's Knowledge Management Lab and led major projects as principal investigator at the NSF, NASA, and the Air Force Research Lab.

#### Lorrie Faith Cranor, D.Sc., *Mis-*



*souri Gamma '96*, has been appointed director of Carnegie Mellon University's security and privacy institute, CyLab. Cranor is a professor of computer science

and of engineering and public policy at CMU. She took leave for a year to serve as the chief technologist for the U.S. Federal Trade Commission (2016-17) and co-founded Wombat Security Technologies, Inc., a security awareness training company.

#### James H. Garrett Jr., Ph.D., P.E.,



*Pennsylvania Gamma '82*, is now provost at Carnegie Mellon University where he had served as dean of engineering since 2013. He began his new position on

January 1, 2019. Previously, Garrett was head of Carnegie Mellon's department of civil and environmental engineering. He is a founding co-director of the Smart Infrastructure Institute, a research center.

**Domenico Grasso, Ph.D., P.E.,** *Michigan Gamma '87*, has become



chancellor of the University of Michigan-Dearborn. He is an engineering professor who has also served as provost and chief academic officer at the University of Delaware. Grasso earned his Ph.D. in environmental engineering at U-M.

**Thomas C. Katsouleas, Ph.D.,** *California Delta '84*, has been named



as president of the University of Connecticut. He was executive vice president and provost of the University of Virginia. Katsouleas is a plasma scientist and engineer who started his career in academia at the University of Southern California as an associate professor of electrical engineering.

**Tsu-Jae King Liu, Ph.D.,** *California Gamma '84*, has been chosen as



the new dean of University of California, Berkeley, college of engineering. She was UC Berkeley's vice provost for academic and space planning, and professor and former chair of the department of electrical engineering and computer sciences.

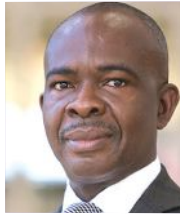
**Adrienne R. Minerick, Ph.D.,** *Michigan Beta '98*, has become dean of



Michigan Technological University's school of technology. Previously, she was an associate dean in the college of engineering and a professor of chemical engineering. Minerick's primary area of research is electrokinetics with a

focus on medical microdevices, blood cell dynamics, and point-of-care diagnostics.

**George A. Nnanna, Ph.D., P.E.,** *Texas Eta '01*, is now dean of the



University of Texas Permian Basin college of engineering. He previously served as director of the Purdue Calumet Water Institute, and was also head of the mechanical and civil engineering departments at Purdue University Northwest.

**Larry A. Simonson, Ph.D., P.E.,** *South Dakota Alpha '69*, has



been appointed assistant to the president-alumni ambassador at the South Dakota School of Mines and Technology. He was formerly executive director of the South Dakota Mines Alumni Association. His duties will include assisting the association in coordinating alumni events, outreach, and data base research. Simonson is a former TBPI president and Advisor to SD A.

**Steven K. Starrett, Ph.D., P.E.,** *Kansas Gamma '89*, is now dean of the



school of engineering and engineering technology at LeTourneau University. He is a fellow of the American Society of Civil Engineers and president of the ASCE's environmental and water resources institute. He has held leadership roles at Kansas State University over the past 20 years.

## FACILITIES

**Massachusetts Institute of Technology** has received a \$350 million

gift from investment banker Stephen Schwarzman, which it will use to "rewire" how it educates computer students.

The money will help finance a new building that will house a college of computing named for Schwarzman. It will also allow MIT to cope with the rising demand for computer science courses from students majoring in any discipline by paying for 50 new faculty members.

### **SUNY Polytechnic Institute's**

Albany, NY, campus is site of the AI Hardware Center where IBM is plowing \$2 billion into a new artificial intelligence research hub to boost growth from emerging technologies.

The center will focus on computer-chip research, development, prototyping, testing, and simulation, IBM said in a statement. New York Governor Andrew Cuomo announced the investment, in partnership with New York State, and said the center would attract new companies in the AI field and federal research, and create several hundred new jobs.

### **University of Virginia** has

announced the launch of a school of data science, backed by a \$120 million gift from the Quantitative Foundation, the largest private donation to the state flagship university in Charlottesville.

The foundation has previously given \$30 million to UVA, including \$10 million to support the Data Science Institute. The university said it also plans to add \$80 million to the venture from its own funding for a total investment of \$200 million.

**University of Wyoming** college of engineering and applied science has begun moving into its new \$105 million home. The four-story building includes reconfigurable research laboratories, active-learning classrooms, a drilling and completions simulation laboratory, a student innovation center, and a student entrepreneurship center. The facility has space that can be reprogrammed without major renovation.



# Brain Ticklers

## RESULTS FROM FALL

### Perfect

*Bohdan, Timothy E.	IN	Γ	'85
Couillard, J. Gregory	IL	A	'89
Gerken, Gary M.	CA	H	'11
*Griggs Jr., James L.	OH	A	'56
Richards, John R.	NJ	B	'76
*Slegel, Timothy J.	PA	A	'80

### Other

Alexander, Jay A.	IL	Γ	'86
Aron, Gert	IA	B	'58
Budd, Christopher M.	AZ	B	'94
Dechman, Don A.	TX	A	'57
Ellis Jr., Ira T.	PA	H	'56
*Gaston, Charles A.	PA	B	'61
Gee, Albert	CA	A	'79
Gee, Aaron J.	CA	Ψ	'16
*Gulian, Franklin J.	DE	A	'83
Gulian, William F.	Son of member		
Handley, Vernon K.	GA	A	'86
Johnson, Mark C.	IL	A	'00
Johnson, Roger W.	MN	A	'79
Jordan, R. Jeffrey	OK	Γ	'00
Kimsey, David B.	AL	A	'71
Lalinsky, Mark A.	MI	Γ	'77
Marrone, James I.	IN	A	'61
*Norris, Thomas G.	OK	A	'56
Norris Jr., Thomas G.	PA	Γ	'79
Rentz, Peter E.	IN	A	'55
Riedesel, Jeremy M.	OH	B	'96
Schmidt, V. Hugo	WA	B	'51
Spong, Robert N.	UT	A	'58
Summerfield, Steven L.	MO	Γ	'85
Voellinger, Edward J.	Non-member		
Zison, Stanley W.	CA	Θ	'87

\*Denotes correct bonus solution

## FALL REVIEW

The Fall Ticklers appear to have been more difficult than usual. Fewer than half the answers submitted for problems 2 (Hook, Line, and Sink), and 4 (queens on a chess board) were correct. Also, only half the solutions submitted for the Bonus problem (numbers on foreheads) were correct.

We apologize to **Hubert W.**

**Hagadorn, PA E '59**, for misspelling his name as the submitter of Winter Problem No. 4.

## WINTER ANSWERS

**1** CORNELL + STUDENT = ENDURES translates into **5481977 + 3620916 = 9102893**. For there not

to be a carry into the fourth column (denoted here as a binary flag  $c_4$ ),  $E < 5$  leading either to  $L + N + c_3 < 5$  or  $9 < L + N + c_3 < 15$ . For the first case,  $L \neq 0$  because this implies  $T = S$ .  $N \neq 0$  because this implies  $D = U$  under the assumption of no  $c_4$ .  $L$  and  $N$  cannot take on the pair of values 1 and 2 (nor 1 and 3) in either order because this would eliminate all valid possibilities for  $C$  and  $S$ . So  $L + N + c_3 \geq 5$ . For the second case, there must be a carry  $c_3$ , which implies a carry  $c_6$ . Checking where  $E = 3$  and  $L + N = 12$  yields no combination of  $L$  and  $N$  (there are four) resulting in a valid set of  $S, C, T, R, O, U$  and  $D$ . Similar results are found when  $E = 4$  and  $L + N = 13$  (again, in four combinations). So  $c_4$  must exist.

Note  $1 + N + D = 10c_3 + U$  and  $R + U + c_3 = D + 10c_2$ . Combining these constraints yields  $R + N = 9c_3 - 1 + 10c_2$ . It follows that  $c_3$  or  $c_2$  must be a carry but not both, and  $R + N = 8$  or 9.

Now consider the carry  $c_5$ , which would arise only if there is a carry  $c_6$  and  $L + N > 13$ , or if there is no carry  $c_6$  and  $L + N > 14$ . Considering values of  $L$  (which cannot be 9) and  $N$  that satisfy this constraint, and the resulting values of  $E$  and  $R$ , only one pair obeys the rule that  $R + N = 8$  or 9, which is  $L = 6, N = 8$  implying there is a carry  $c_6$  leading to  $E = 5$  and  $R = 1$ . It follows that  $S = 3, C = 2, T = 7$ , and  $O = 0$ . Alas, the remaining letters  $U$  and  $D$  cannot be filled with 4 and 9 in any valid combination, and there can be no carry  $c_5$ . This fact creates the restriction  $4 < L + N < 9$ .

Under this last constraint, take first the case where there is no carry  $c_6$ . Considering values of  $L$  and  $N$  that satisfy this constraint, and with the resulting values of  $E$  and  $R$ , only two sets of these letters obey the rule that  $R + N = 8$  or 9.

The first has  $L = 2, N = 5, E = 7$  and  $R = 4$ , leading to  $T = 1$  and  $S = 3$ , but no valid choice for  $C$ . The second has  $L = 5, N = 3, E = 8$  and  $R = 6$ , leading to  $T = 2, S = 7$  and  $C = 1$ , and  $O = 0$  with a necessary carry  $c_2$ . Alas, once again

the remaining letters  $U$  and  $D$  cannot be filled with 4 and 9 in any valid combination, and there must be a carry  $c_6$ . In this case, we once again consider values of  $L$  and  $N$  that satisfy the above constraint, and with the resulting values of  $E$  and  $R$ , only four sets of these letters obey the rule that  $R + N = 8$  or 9.

The first has  $L = 1, N = 5, E = 7$  and  $R = 4$ . It implies that  $T = 9$ , but leads to no valid choice for  $S$ . The second has  $L = 5, N = 2, E = 8$  and  $R = 6$ , leading to  $T = 9, S = 3$  and  $C = 4$ , but no valid choice for  $O$ . The third has  $L = 4, N = 3, E = 8$  and  $R = 6$ , leading to  $T = 7, S = 2$  and  $C = 5$ , but no valid choice for  $O$ . This forces  $L = 7, N = 1, E = 9$  and  $R = 8$ .  $T$  cannot be 4, because  $S$  cannot be 1.  $T$  cannot be 5, because it leads to  $S = 2, C = 6$  and no valid choice for  $O$ . Thus  $T = 6, S = 3, C = 5$ , and  $O = 4$ . The problem is fully solved by assigning  $D = 0$  and  $U = 2$ .

## 2 The order of the months in Bonkers' year is Collywobble, Stephen, Strawberry, Jinks, Pinafore, Tiddlywinks, and Cucumber.

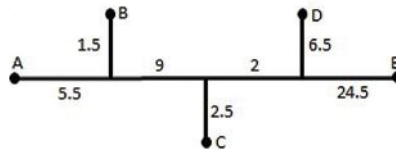
In 21 a.b., **Collywobble 2<sup>nd</sup> is a Joyday**. With 10 weeks (50 days) between Collywobble 41<sup>st</sup> and Pinafore 7<sup>th</sup>, Collywobble accounts for 3 days and Pinafore 7. This leaves 40 days to account for by the middle months. The only way to achieve 40 days is to have a 19-day month, a 17-day month, and a 4-day month in some order. Strawberry or Cucumber is one of the months, Tiddlywinks or Jinks is another of the months, and Stephen is a third. Since Blissday is two days after Funday, the king's holiday was  $7 \times 5 + 2 = 37$  days long. Strawberry accounts for 2 days, and Tiddlywinks accounts for 8. There are, therefore, 27 days to account for by middle months. There are two situations to consider here: the first arises when the king returns sometime after the new year in 18 a.b. In this case, Collywobble would contribute 13 days, leaving 14 days unaccounted for. The only way to partition what is left is to

include Pinafore (10) and Stephen (4), the latter of which must be after Collywobble in 18 a.b. We know, however, that Pinafore must be four months after Collywobble, making the above arrangement impossible; the king must return sometime in 17 a.b. In this situation, the only way to achieve 27 days is with Pinafore and Jinks in some order. Collywobble cannot be between Strawberry and Tiddlywinks (cyclically speaking), so must be either right after Tiddlywinks or the following month. If it is immediately after Tiddlywinks, Pinafore must be right after Strawberry, and Cucumber would need to follow Pinafore, but since this is between Strawberry and Tiddlywinks, this is a contradiction. So, Collywobble is two months after Tiddlywinks, Pinafore is just before Tiddlywinks, and Cucumber is just after Tiddlywinks. It follows that Stephen must be directly after Collywobble and Jinks directly after Strawberry. In 21 a.b., Collywobble has 44 days and Stephen has 4 days. There are  $42+4+13=59$  days between the dates in question. Since  $59 \bmod 5=4$ , Strawberry 13<sup>th</sup> (a Workday) is four weekdays after Collywobble 2<sup>nd</sup>, making the latter a Joyday.

**3** The  $x$  with the smallest positive numerator and denominator\* is **1681/144**. Let  $x$  be represented as  $p^2/q^2$ , so the remaining two numbers of interest are  $(p^2+5q^2)/q^2$ . Considering just the numerators, define  $a^2=p^2-5q^2$ ,  $b^2=p^2$ , and  $c^2=p^2+5q^2$ . Then, define  $D=c^2-b^2=b^2-a^2$ . Rearranging gives two equations  $c^2=b^2+D$  and  $a^2=b^2-D$ . Multiplying these two equations together and rearranging gives  $(ca)^2+D^2=(b^2)^2$ . This is a well known Diophantine equation of the same form as is used for generating Pythagorean triples. It has a parametric solution for integer  $m$  and  $n$ :  $ca = m^2-n^2$ ,  $D=2mn$ ,  $b^2=m^2+n^2$ , the latter expression being of a similar Diophantine form. Repeating, if for integer  $r$  and  $s$  we set  $b=r^2+s^2$ ,  $m=2rs$ ,  $n=r^2-s^2$  and plug them into the expressions for  $D$  and  $b^2$  we

get  $D=4rs(r^2-s^2)$  and  $b^2=(r^2+s^2)^2$ . It remains to find integers  $r$  and  $s$  that make the smallest integer of the form  $5q^2$ . Either  $r$  or  $s$  must be 5, and a quick check reveals  $r=5$  and  $s=4$  give  $D=720=5 \times 12^2$  and  $q^2=144$ .  $b^2=(5^2+4^2)^2=p^2=1681$ , so  $x=1681/144$ . [\* **James R. Roche**, IN  $\Gamma$ '85, rightly points out there is technically no "smallest  $x$ " when measuring the value of  $p/q$ ; provided  $p$  and  $q$  are sufficiently large  $p/q$  can get arbitrarily close to 0. Despite the misleading wording, our 13th century mathematicians were indeed angling for the simplistic ratio with smallest positive integer  $p$  and  $q$ —the contest's answer given above was found by none other than Fibonacci!]

**4** The number of towns is **five**, and they are **connected as depicted in the diagram below**. Total road length is 51.5km.



The number of towns must be five, since the number of routes is 10 and  $C(10,2) = 5$ . Since there is a unique path between each pair of cities, there can be no loops. For 5 towns, the above picture shows the generic topology—note however that other derivative forms could be created by setting individual road segments to a length of zero. Assigning the seven road segments with variables  $a$  through  $g$ , we can find the route length between any of the cities A,B,C,D or E by the following ten equations (AB denotes the distance from A to B):

1.  $AB = a + b$
2.  $AC = a + c + d$
3.  $AD = a + c + e + f$
4.  $AE = a + c + e + g$
5.  $BC = b + c + d$
6.  $BD = b + c + e + f$
7.  $BE = b + c + e + g$
8.  $CD = d + e + f$
9.  $CE = d + e + g$
10.  $DE = f + g$

To solving for the road segment lengths,  $a$  and  $b$  are obtained from (1) and the difference of (2) and (5);  $f$  and  $g$  are obtained from (10) and the difference of (8) and (9);  $c$  and  $e$  are obtained from (3) and the difference

of (2) and (8);  $d$  is obtained from (2).

The resulting equations are:

$$a = (AB + AC - BC)/2$$

$$b = (AB - AC + BC)/2$$

$$c = (AD - CD - AB + BC)/2$$

$$d = (AC - AD + CD)/2$$

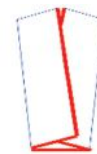
$$e = (AD - AC - DE + CE)/2$$

$$f = (DE + CD - CE)/2$$

$$g = (DE - CD + CE)/2$$

One approach to solving is to write a quick program: start from the first ten primes, choose seven and assign them to the various route lengths. With the resulting  $a$  through  $g$ , check to ensure that the remaining three routes are equal in length to the remaining three primes. In the event no valid solution is found, increase the window of primes by one and repeat. Doing so quickly reveals that a valid solution exists with primes from 7 through 41 and has  $a=5.5$  km,  $b=1.5$  km,  $c=9$  km,  $d=2.5$  km,  $e=2$  km,  $f=6.5$  km and  $g=24.5$  km (resulting in a total road length of 51 km). Additionally,  $AB=7$  km,  $AC=17$  km,  $AD=23$  km,  $AE=41$  km,  $BC=13$  km,  $BD=19$  km,  $BE=37$  km,  $CD=11$  km,  $CE=29$  km and  $DE=31$  km. Note that symmetrical equivalent solutions will exist where  $a, b, f$  and  $g$  can be interchanged, and  $c$  and  $e$  can be interchanged.

**5** **Five folds** are required. One solution follows: Create a horizontal fold by bringing the top edge to the center of the square. Next bring the right edge in, making a not-quite



vertical fold that has a steep positive slope. The uppermost point after the fold will be just to the right of the center vertical line of the original square. Repeat

in a symmetric way with the left edge; this results in the figure at left:

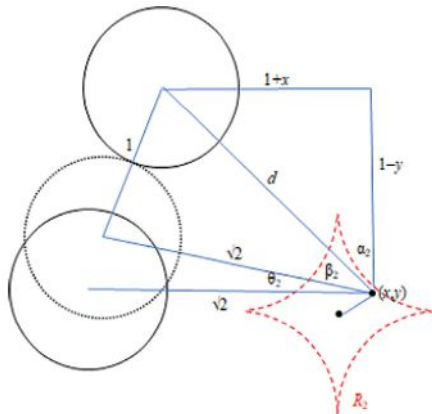
Next create a horizontal fold about  $\frac{1}{2}$  of the way down from the top, and finish by taking the bottom portion, folding it up and into the pocket created by the previous fold. The result will look something like this:



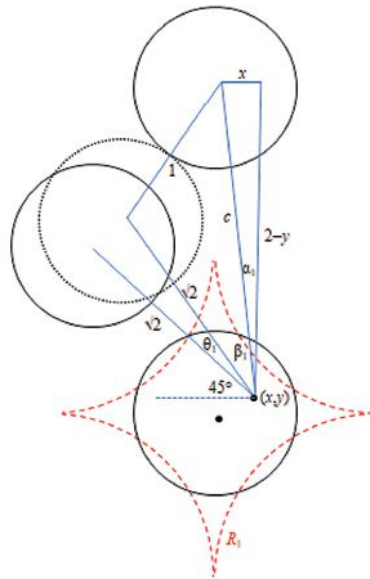
**Bonus** The probability that no overlap will occur is **approximately 2.49%**. To approach this problem, it may help to create a physical model with a grid of polka dots printed on paper and 4 additional dots in the same pattern placed on a plastic transparency that can be moved around. A little sleuthing will show that, to avoid overlapping dots, the center of the plastic square can only be in two regions. The first region,  $R_1$ , is centered around the center of a polka dot on the tablecloth (with the plastic not rotated with respect to the grid). The second region,  $R_2$ , is centered about the center of the square defined by the center of four adjacent polka dots (with the plastic rotated by  $45^\circ$  with respect to the grid). By shifting the plastic about the centerpoint to see the maximum extent that can be reached before overlap occurs, it is readily apparent that each region is vaguely diamond shaped, where the 4 convex "sides" are arcs of circles. In  $R_1$  the circle radius is 1, and in  $R_2$  the circle radius is  $r=1-\sqrt{2\sqrt{2}-2}$ . When the plastic is translated from the region  $R_i$  center by  $(x,y)$ , we wish to find out the amount of rotation  $\theta_i$  about  $(x,y)$  that is allowed before the polka dots on the plastic begin to overlap the polka dots on the tablecloth. Symmetry enables us to focus on one quadrant of the region, a clockwise rotation, and the behavior of one dot on the plastic. Out of  $\pi/2$  radians, there will be  $2\theta_i$  radians of rotation with no overlap, or a  $4\theta_i/\pi$  probability. The overall probability will then be

$$\frac{4}{\pi} \int_0^1 \int_0^{1-\sqrt{1-(x-1)^2}} \theta_1(x,y) dy dx + \frac{4}{\pi} \int_0^r \int_0^{r-\sqrt{-(x-r)^2}} \theta_2(x,y) dy dx$$

It remains to find  $\theta_i(x,y)$ . The following diagram depicts the case around  $R_1$ :



$c^2=x^2+y^2-4y+4$ , and  $\alpha_1 = \text{acos}((2-y)/c)$ . Using the law of cosines gives  $\beta_1=\text{acos}((1+c^2)/(2\sqrt{2}c))$ . We arrive at  $\theta_1=\pi/4-\alpha_1-\beta_1=\pi/4-\text{acos}((2-y)/\sqrt{(x^2+y^2-4y+4)})-\text{acos}((x^2+y^2-4y+5)/(2\sqrt{2}\sqrt{(x^2+y^2-4y+4)}))$ . The diagram below depicts the case around  $R_2$  (note it is not to scale due to the small size of the region):



$d^2=x^2+y^2+2x-2y+2$ , and  $\alpha_2 = \text{acos}((1-y)/d)$ . Using the law of cosines gives  $\beta_2=\text{acos}((1+d^2)/(2\sqrt{2}d))$ . We arrive at  $\theta_2=\pi/2-\alpha_2-\beta_2=\pi/2-\text{acos}((1-y)/\sqrt{(x^2+y^2+2x-2y+2)})-\text{acos}((x^2+y^2+2x-2y+3)/(2\sqrt{2}\sqrt{(x^2+y^2+2x-2y+2)}))$ . A closed form solution is not possible because the above integrands lead to an elliptical integral. Relying on

numerical integration methods leads to a probability of about 2.475% that there is no overlap when the center lies in  $R_1$ , and a probability of about 0.019% that there is no overlap when the center lies in  $R_2$ . The total probability is the sum of these two results, which with rounding gives about 2.49%.

**Computer Bonus** The longest string is **94 integers**. In the range from 1 to 1 billion, there is exactly one run of 94 integers from 981,270,903 to 981,270,996, inclusive, that contains no semiprimes.

## NEW SPRING PROBLEMS

**1** Solve the following cryptic addition in base 11. All the usual rules apply; each different letter stands for a different digit, and each different digit is always represented by the same letter; there are no leading zeros. Use  $a$  to represent the digit 10.

## TICKLER = STRAINS + BRAINS

—Howard G. McIlvried, III,  
PA Γ '53

**2** What is the maximum number of knights that can be placed on a standard  $8 \times 8$  chess board, so that each knight threatens (i.e., can capture) exactly one other knight, and how are they arranged? A knight moves two squares in one direction and one square in another direction to end up on a square of opposite color. This move can occur even if intervening squares are occupied. In this puzzle, each knight can move to exactly one square occupied by another knight, but not to two or more occupied squares. Present your answer as an  $8 \times 8$  grid (representing a chessboard) with the locations of the knights represented by Ns and the unoccupied squares represented by dashes.

—A Passion for Mathematics  
by Clifford A. Pickover

**3** I am getting a new sign for my shop, and instead of showing the

shop number as numeric digits, it will be spelled out in capital letters, one word per digit. For example, if my shop number were 103, it would be painted as ONE ZERO THREE. The sign painter is a little eccentric, and instead of charging by the hour, he charges by the brush stroke, which can be any shape and can touch, but must not cover, an already painted area (except where changing direction). He paints capital letters in a simple style (no serifs) and does not use two strokes where a single stroke will do. For example, E, F, G, H, I, N, O, R, S, T, U, V, W, X, Z would require 2, 2, 2, 3, 1, 1, 1, 1, 1, 2, 1, 1, 2, and 1 strokes, respectively. My shop number, which I had spelled out for the painter when he arrived, is a prime number, consisting of three different digits. He charges \$1 per stroke, regardless of the length of the stroke. By coincidence, the cost of my number in dollars was equal to the sum of the three digits in the shop number and was a prime. What is my shop number?

—Enigma in *New Scientist*  
by Susan Denham

4 Joe is playing five-card draw poker. He is dealt the 4, 5, and 6 of hearts, the 3 of diamonds, and the 10 of spades. He decides to discard the 3 and 10 and draw two new cards. What is the probability that he will improve his hand by getting one pair or better? Assume that Joe sees only the cards dealt to him and knows nothing about the other

players' cards. In five-card draw, each player is dealt five cards face down. After looking at the cards, if he is not satisfied, he can turn in up to three cards (face down) and get replacements.

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

5 We are all familiar with the story of the 1001 Arabian Nights. Find  $N$  such that  $N!$  ( $N$  factorial) has one digit for each of the Arabian Nights.

—H. S. Uhler

**Bonus** Find three consecutive triangular numbers whose product is a perfect square. The first such set is  $6 \times 10 \times 15 = 900 = 30^2$ , and the second such set is  $300 \times 325 \times 351 = 34,222,500 = 5850^2$ . What is the third such set, and what is the square root of their product? A triangular number is a number of the form  $n(n+1)/2$ , where  $n$  is a positive integer.

—*Elementary Number Theory*  
by David M. Burton

**Computer Bonus** What is the largest base-10 prime, such that when the leading digit is successively removed until only one digit remains, the resulting series of integers, including the final digit, are all primes? Leading zeros are not allowed, and 1 is not a prime number.

—*Penguin Dictionary of Curious and Interesting Numbers*  
by David Wells

Postal mail your answers to any or all of the Brain Ticklers to **Tau**

**Beta Pi, P. O. Box 2697, Knoxville, TN 37901-2697** or email to *BrainTicklers@tbp.org* as plain text only. The cutoff date for entries to the spring column is the appearance of the Summer *Bent* which typically arrives in mid-June (the digital distribution is several days earlier). The method of solution is not necessary. The Computer Bonus is not graded. We additionally welcome any interesting problems that might be suitable for the column. Entries will be forwarded to the judges who are **F.J. Tydeman, CA Δ '73; J.C. Rasbold, OH A '83; J.R. Stribling, CA A '92** and the columnist for this issue,  
—**H.G. McIlvried, III, PA Γ '53**

### "THE BEST PEOPLE" ENGINEERING JOB BOARD

Through a partnership with Your-Membership, Tau Beta Pi is proud to offer a job board for students and alumni. Members can post resumes, browse over 5,400 engineering jobs, faculty positions, and internships, and employers may browse resumes.

New opportunities are posted on our home page daily and a full list of openings are available by visiting [www.tbp.org/memb/jobBoard.cfm](http://www.tbp.org/memb/jobBoard.cfm).

## VOLUNTEERS WANTED

Every three years, the Executive Council is charged with appointing directors of various Association programs. The Council is seeking interested members to fill the positions of Director of Alumni Affairs, Director of the District Program, Director of Engineering Futures, Director of Fellowships, and Director of Rituals. Those selected to fill these roles must be willing and able to serve from July 1, 2019, until June 30, 2022.

Each position has unique qualifications, desired experience, and time commitment, which are outlined on the website at [www.tbp.org/about/programDirectors.cfm](http://www.tbp.org/about/programDirectors.cfm). For all five positions, the Council is looking for volunteers who are passionate about Tau Beta Pi and interested in giving of their time and talent to benefit the Association

and our members. Travel requirements vary for each role, but the ability to attend the annual Convention is required. Past experience and knowledge of the Association and its operations is required. The deadline to submit an application is May 15, 2019. It should be addressed to "The Executive Council" and emailed to [tbp@tbp.org](mailto:tbp@tbp.org). There is no application form, but interested individuals should include a current resume and a letter stating the applicant's interest in the position, relevant past experience that would benefit the Association, and summary of ideas and vision for the position. If you would like additional information, please send an email to [tbp@tbp.org](mailto:tbp@tbp.org). A member of the Executive Council will follow up with you about your interest or questions.



## 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 email or write the Editor for additional facts (if available) concerning the following deceased members. The assistance of all is earnestly sought in reporting the deaths of Association members, with appropriate details, including date of death and full name. You may report the death of a member by sending an email to [chapter.eternal@tbp.org](mailto:chapter.eternal@tbp.org).*

- AL A '47 **Appleton, Joseph Hayne**; January 17, 2019.  
 '51 **Lowrey, Gordon M.**; August 1, 1990.  
 '51 **McGough, Herbert Neal**; December 18, 2018.  
 '52 **Dowdle, Joseph Clyde**; August 21, 2004.  
 '52 **McCrary, Douglas Langston**; January 5, 2019.
- AL B '51 **Malone, Charles Lovelace**; June 2, 2015.  
 '52 **Barr, Jack Sterling**; April 20, 2018.  
 '52 **Evans, Francis Elmond**; April 30, 2012.  
 '57 **Pohmajevich, Francis**; October 18, 2017.  
 '63 **Gasper, Frank Paul**; December 2, 2018.
- AZ B '51 **Klock, John Weston**; September 22, 2011.
- AR A '52 **Pollock, Charles Edward**; March 4, 2001.
- CA A '49 **Scesa, Steve**; October 13, 2016.  
 '51 **Hornbeck, Charles Lloyd**; July 30, 2018.  
 '53 **Wong, Richard C.**; May 17, 2015.
- CA Γ '41 **Cilker Sr., William Hamilton**; April 3, 2018.  
 '42 **Kays, William Morrow**; September 9, 2018.
- CA Δ '50 **Stokes, Hayman Wilson**; November 14, 2018.
- CA E '49 **Perrine, Richard Leroy**; no details.  
 '57 **Curry Jr., Winfield Scott**; September 12, 2017.
- CA Z '75 **Fisher, Dean Lawrence**; November 10, 2018.
- CA Θ '78 **Nguyen, Fleming M.**; February 7, 2013.
- CO B '44 **Greger, Leonard Robert**; July 31, 2018.  
 '49 **Taylor, Charles Edward**; February 18, 2018.  
 '52 **Gorman, John Vincent**; March 18, 2004.
- CO Γ '57 **Altman, Donald Clyde**; July 17, 2015.
- CT B '76 **Jankovich, Scott Allan**; August 27, 2007.
- DE A '48 **Ferron, John Royal**; March 19, 2015.  
 '61 **White, James William**; January 8, 2017.  
 '62 **Sealman, Thomas Francis**; no details.
- DC Γ '49 **Ritchie, Frederick Monks**; December 19, 2017.  
 '60 **Mayo, Henry Casablanca**; January 26, 2018.
- FL A '58 **Beard Jr., Percy Morris**; December 23, 2018.  
 '83 **Agee, William Michael**; December 3, 2018.
- FL B '65 **Decario, Victor**; June 29, 2018.
- GA A '52 **Sawyer, James Ernest**; March 18, 2016.  
 '52 **Scobey Jr., James Edward**; February 14, 2010.  
 '62 **McDaniel Jr., William Henry**; no details.
- IL A '44 **Shapland, Robert Ross**; September 26, 2018.  
 '50 **Hankins, Donald Gene**; May 28, 2015.  
 '50 **Slaker, Frank Allen**; April 22, 2015.  
 '51 **McWhorter, Alan Louis**; July 10, 2018.  
 '52 **Shewmon, Paul Griffith**; November 26, 2015.  
 '53 **Schnobrich, William**; August 13, 2016.  
 '56 **Ray, John D.**; August 4, 2006.  
 '56 **Sipowich, Robert William**; May 21, 2014.  
 '56 **Toepfer Jr., Richard Earl**; no details.  
 '60 **Reed, Cordell**; December 4, 2017.
- IL B '47 **Medin, Grant Elmer**; no details.  
 '63 **Marsh, Wayne Gerald**; December 7, 2018.
- IL Γ '43 **Brazelton, William Thomas**; January 8, 2019.  
 '48 **Weertman, Johannes**; October 13, 2018.  
 '51 **Down, Alfred George**; no details.  
 '59 **Dahlberg, Edward Philip**; May 26, 2018.
- IN A '45 **McDonald, Richard Evers**; January 12, 2018.  
 '46 **Logan, David Malcolm**; January 2, 2013.  
 '49 **Morone, Joseph Peter**; November 15, 2016.  
 '50 **Dykes, James Alfred**; December 10, 2018.  
 '50 **Hagerty, John M.**; November 30, 2017.  
 '51 **Murdock, Jay Homer**; November 23, 2018.  
 '52 **Dotson, John Philip**; no details.
- '52 **Feldmeyer, Richard Eugene**; October 6, 2017.  
 '52 **Jakupco, John Joseph**; March 31, 2018.  
 '53 **Herrin, Moreland**; July 6, 2015.  
 '53 **Kroeschell, Thomas Roy**; March 22, 2017.  
 '58 **Noah, Max Wilbur**; June 15, 2018.  
 '58 **Pearson, Donald**; July 20, 2018.  
 '59 **Mills, Norman Thomas**; March 26, 2018.  
 '69 **Furgason, Eric Scott**; May 31, 2016.
- IN Γ '84 **Pieronek, Catherine Frances**; April 9, 2015.
- IN Δ '62 **Etter, Robert John**; November 14, 2018.
- IA A '49 **Johnson, Howard Paul**; December 9, 2018.  
 '51 **Moyer, James Hardy**; July 5, 2018.  
 '58 **Rothrock, Richard Benjamin**; December 13, 2018.  
 '63 **Patterson III, Ralph E.**; August 26, 2018.  
 '63 **Weber, Robert John**; November 21, 2018.  
 '69 **Crispin, Roger Harvey**; July 23, 2015.  
 '72 **Kerr, Roger Allen**; August 11, 2018.
- IA B '52 **Dinzole Jr., John William**; no details.
- KS A '42 **Ham Jr., James Harrison**; December 25, 2016.
- LA A '51 **Olivier, Fulton Joseph**; no details.  
 '57 **Raborn, Robert Lee**; December 14, 2018.  
 '58 **Stitzlein, Teddy Kenneth**; May 3, 2003.
- LA Γ '50 **Scarborough, N. D.**; August 24, 2005.
- LA Δ '60 **Harrington Jr., Thomas Edgar**; November 30, 2012.  
 '72 **Thibeaux, John M.**; October 15, 2018.
- ME A '39 **Raye, Alexander Hinds**; November 8, 2018 [*Cent. 138*].  
 '65 **Plante, Donald Eugene**; August 27, 2014.
- MD A '48 **Rasch II, William Gustav**; December 25, 2018.  
 '48 **Wolock, Melvin Martin**; December 21, 2018.  
 '49 **Bergstrom, Carl Wallace**; January 11, 2019.  
 '49 **Smith Jr., Leroy Harrington**; March 28, 2018.  
 '50 **Gates, Allen Francis**; September 28, 2018.  
 '51 **Evans, George Dean**; July 22, 2009.
- MD B '50 **Wong, James Bok**; May 25, 2018.  
 '52 **Weckesser Jr., Louis Benjamin**; January 1, 2019.  
 '59 **Kivi, Ahto**; November 10, 2018.
- MA A '41 **Bell, John B.**; June 8, 2000.  
 '46 **Breed, Allen**; January 10, 2019.  
 '51 **Bassett Jr., Leon Hiram**; July 15, 2018.
- MA B '44 **Frailey, Jack Henry**; January 7, 2016.  
 '48 **Harris, Richard Henry**; November 17, 2018.  
 '49 **Griggs, Robert Stephenson**; October 19, 2012.  
 '51 **Seiglie, Jaime Urrea**; July 14, 2011.  
 '51 **Wedan, Robert Warren**; April 8, 2006.  
 '52 **Mankes, Jack Arnold**; August 11, 2003.  
 '52 **Wells, Walter Irvine**; November 12, 2016.  
 '57 **Hooper, William Lyon**; May 21, 2007.  
 '60 **Reinschmidt, Kenneth F.**; December 31, 2018.  
 '62 **Sachs, Murray B.**; March 3, 2018.
- MA Δ '63 **Pearson, Donald James**; August 25, 2018.
- MA E '51 **Greenwood, T. Spencer**; May 29, 1998.
- MA Z '55 **Miller Jr., Melton Myron**; May 28, 2018.  
 '56 **Walker, William Hamilton**; July 13, 2018.  
 '59 **Kennedy, Philip James**; October 18, 2018.
- MI A '51 **Filpus, Uno Wallace**; May 2, 2018.
- MI B '42 **Niessink, Thomas**; May 12, 2016.  
 '50 **Lind, Earl Richard**; December 16, 2013.  
 '52 **Urich, Daniel Martin**; August 5, 2011.  
 '55 **Kytola, John William**; September 14, 2013.
- MI Γ '46 **Hansen, Charles**; October 14, 2018.  
 '50 **Calhoun Jr., Donald Browne**; February 1, 2018.

MI Δ '51 Seeger, Richard Thompson; January 26, 2018.  
 '49 Millar, Gordon Halstead; November 2, 2018.  
 '51 Wanko, Joseph Paul; May 31, 2018.  
 '60 Hoban, Thomas William; June 19, 2018.  
 MI E '51 Delbuono, Amerigo J.; November 13, 2018.  
 MI Z '52 Campbell, David D.; February 4, 2016.  
 '52 Petraits, John Joseph; December 17, 2017.  
 '55 Johnson, Paul Russell; December 21, 2018.  
 MN A '44 Buck, Victor Eugene; October 19, 2018.  
 '44 Grismer Jr., Raymond Leonard; December 25, 2017.  
 '52 Ronning, Albert James; July 2, 2018.  
 '57 Rudd, Dale F.; March 2, 2018.  
 '66 Hennen, Harry Anthony; October 18, 2018.  
 MS A '44 Kyle Jr., Henry Aubrey; September 5, 2009.  
 '50 Cook, John Wesley; January 2, 2016.  
 '57 Summers, Dorris Donald; September 3, 2017.  
 '65 McDonald Jr., Harold Rhodes; December 2, 2018.  
 MS B '77 Watson, Larry Tim; no details.  
 MO A '56 Zastrow, Virgil Armin; October 16, 2018.  
 MO B '43 Nolte, Roger Emerson; October 22, 2015.  
 '50 Gore, Arthur George; January 7, 2019.  
 '52 Wickey, Robert Oscar; June 5, 2018.  
 MT A '51 Voegeli, Frederick Speiden; October 8, 2013.  
 '52 Elwell, Donald Frank; May 11, 2017.  
 NH A '52 Flanders, Theodore Albert; June 24, 2017.  
 NJ A '51 Johnston, Ronald Thomas; December 19, 2018.  
 '52 Williard, Merwin Walter; May 29, 2006.  
 NJ B '50 De Witt, Russell; December 9, 2018.  
 NJ Γ '66 Mansfield, John William; March 23, 2017.  
 NJ Δ '43 Apgar, H. Holt; July 23, 2014.  
 '47 Crom, William Hampton; November 30, 2009.  
 '47 Haacke, Roland Ernst; December 18, 2016.  
 NM A '55 Traina, Leonard Alfred; January 14, 2014.  
 NY A '43 Freund, John Mortimer; December 12, 2018.  
 NY B '47 Merrick, Richard H.; August 23, 2006.  
 '51 Sheehan, Jack Ellis; January 4, 2018.  
 NY Γ '50 Seaman, Robert LeRoy; April 27, 2012.  
 '51 Ellert, Frederick Joseph; July 13, 2005.  
 '51 Litke, Robert Albert; February 6, 2011.  
 '51 Tweel, Roger George; no details.  
 '51 Westlake, William Paul; August 10, 2014.  
 '54 Lam, Sau-Hai; October 29, 2018.  
 '63 Yaros, Steven Francis; September 27, 2018.  
 NY Δ '45 Gieseler, Henry Joseph; July 7, 2017.  
 '46 Scott, Russell Cecil; February 9, 2018.  
 '52 Baum, James Roger; July 12, 2012.  
 '59 Thorp, James Shelby; May 2, 2018.  
 '61 Bodman III, Samuel Wright; September 7, 2018.  
 NY E '50 Skaperdas, Dominic O.; January 9, 2016.  
 NY Z '42 Janssen, Gunter Frederick; September 28, 2011.  
 '49 Carey Jr., Alfred William; September 17, 2017.  
 NY H '44 Newman, Sheldon Oscar; October 12, 2018.  
 NY I '51 Sackman, Jerome Leo; December 8, 2016.  
 NY K '50 Savage, James Bernard; December 3, 2018.  
 NY N '49 Stone, Henry E.; December 1, 2018.  
 NC A '51 Martin, Donald Crowell; February 11, 2005.  
 '68 Kitson, Richard Palmer; no details.  
 NC Γ '49 Bugg Jr., Richard Alexander; June 21, 2017.  
 '51 Dellinger, David C.; April 13, 2015.  
 '51 Fenner, William Eaton; July 13, 2011.  
 '61 Carroll, Wayne Douglas; no details.  
 NC E '87 Smith, Jacquelyn A.; November 30, 2018.  
 ND A '78 Boe, Lowell Sidney; October 22, 2017.  
 OH A '43 Schurr, Charles Allan; October 11, 2018.  
 '51 MacAllister, Edward Neil; August 12, 2010.  
 '61 Zych, Dale Allen; April 5, 2016.  
 OH Γ '47 Truxall, Fred W.; December 26, 2018.  
 '48 Rule, Robert Marshall; April 23, 2015.  
 '49 Harbour, Don James; August 28, 2018.  
 OH Δ '59 La Fond, Norman Robert; no details.  
 '63 Ridgeway, Gerald Eugene; October 10, 2018.  
 OH Z '55 Baumberger, John George; November 11, 2018.  
 OH H '51 Lambrecht, Donald William; March 8, 2013.  
 '52 Hall, Titus C.; no details.  
 '63 Burt, Robert Leroy; July 18, 2018.  
 OK A '43 Brown, Edward Sage; November 27, 2018.  
 '51 Austin, Lloyd Gene; April 30, 2015.  
 OR A '63 Patterson, Glenn John; September 13, 2017.  
 OR B '43 Riley, Jack C.; June 29, 2016.  
 PA A '48 Esser, Jefferson Randolph Cary; December 19, 2018.  
 '56 Bachman, Dale Franklin; October 23, 2018.  
 '58 McMichael, Francis Clay; July 28, 2018.  
 '59 Kauffman, Willard Leonard; October 28, 2015.  
 PA B '49 Skipper, Robert Edmond; November 9, 2018.  
 PA Γ '54 Hagaman, Robert T.; October 19, 2018.  
 PA Δ '49 Gross, Robert A.; no details.  
 '51 Heath, Frank Russell; no details.  
 PA Z '42 Koenig Jr., William Adam; September 10, 2015.  
 '51 Arehart, Robert Franklin; December 16, 2017.  
 '51 Feldbaumer, William Charles; January 2, 2019.  
 '51 Herman, Marvin; January 2, 2015.  
 '51 Spencer, Albert Edward; November 28, 2014.  
 PA H '51 Warenko, Norbert Robert; July 23, 2012.  
 '54 Bostian Jr., Harry Edward; November 10, 2012.  
 '64 Anderson, William Carl; November 25, 2018.  
 '67 Menichello, Joseph Michael; January 13, 2019.  
 PA I '68 Hudgins, John Thomas; August 16, 2013.  
 PA K '51 Yntema, John Arend; January 18, 2019.  
 SC A '52 Hendrix, Jack Hardin; December 24, 2001.  
 SC B '51 Broom, Walter Furman; July 3, 2002.  
 SD A '50 Kehm, Roger Lewis; July 16, 2018.  
 TN A '48 Solomon, Ramon L.; August 12, 2010.  
 '49 Whitsitt Jr., Howard Allen; March 5, 2016.  
 '51 Jonakin, Kenneth Wilson; October 24, 2007.  
 '51 Ratliff, Ernest Keller; February 25, 2001.  
 '52 Burguet, Rafael Angel; no details.  
 '52 Moyers, John Clifton; January 12, 2019.  
 '57 Rochat, Raymond Agenor; December 17, 2018.  
 TN B '50 Pinkerton, John Morgan; November 17, 2018.  
 '51 Peck, Maryly Van Leer; November 3, 2011.  
 '85 Garcia, Ephraim; September 10, 2014.  
 TX A '49 Von Rosenberg, Hermann Eugene; August 18, 2011.  
 '51 Yeager Jr., Wilbur Arthur; October 21, 2014.  
 '58 Zinsmeyer, Herbert Gerald; March 28, 2018.  
 TX B '51 Hunt, Charles Bradford; March 19, 2006.  
 '51 Rector, Walter Tucker; August 1, 2015.  
 TX Γ '48 Ligon, Richard Manning; December 17, 2018.  
 '71 Fish, Jim David; June 5, 2017.  
 TX Δ '51 Presswood, Newell Augusta; no details.  
 '53 Bradford, Robert Ingram; November 22, 2018.  
 '61 Liles, Billy Ray; November 21, 2015.  
 '91 Guggisberg, Brent Burton; March 26, 2018.  
 UT A '44 Smith, Richard Horne; April 5, 2013.  
 VT A '51 Von Turkovich, Branimir F.; November 25, 2014.  
 VA A '52 Gantt, Wyatt Harvey; April 12, 2013.  
 VA B '43 Eldred Jr., Everrett F.; August 26, 2017.  
 '50 Cooper, Leon Milton; February 18, 2018.  
 '50 Maddock, Thomas Smothers; February 3, 2018.  
 '51 Miller Sr., William Tomlinson; November 9, 2018.  
 WAA '51 Tokola, Alpo John; March 15, 2013.  
 '76 Swanson, Hilmer Sigfrid; November 23, 2018.  
 WAB '51 Ambrose, William Donnell; March 24, 2018.  
 '51 Campbell, Ralph Harris; April 6, 2017.  
 '52 Scheel, Caryl Eugene; June 29, 2014.  
 WVA '67 Turner, Kenneth Richard; December 16, 2018.  
 WV B '71 Hudnall, George W.; July 1, 2018.  
 WI B '51 Koll, Robert Eugene; March 4, 2013.  
 '61 Wirtz, Gerald Paul; May 31, 2017.  
 WI Γ '77 Laper, Peter Mark; December 31, 2017.



## FAMILIES

### Centenarians

We add **two** members who have reached their second century and been recognized in *The Bent*. The full list is available at [www.tbp.org](http://www.tbp.org) under Distinguished Members.

Harold I. Taylor Jr., *KS A '38*  
b. July 27, 1918

Alexander H. Raye, *ME A '39*  
b. September 27, 1918  
d. November 8, 2018

### Bi-Spousal

We welcome more Tau Beta Pi couples to this most popular category.

Douglas A. Abraham, *CT B '87*  
Mary L. Estacion, *DC B '87*

Eric M. Fortier, *TX B '19*  
Tia D. Fortier, *TX B '19*

Mark N. Glauser, *NY N '82*  
Gina J. Lee-Glauser, *NY N '82*

Joseph M. Imbrogno, *NY O '12*  
Christina Imbrogno, *NY O '14*

Theodore V. Lenthe, *PA A '75*  
Alice E. Lenthe, *PA A '78*

Scott T. Miller, *PA B '02*  
Carrie B. Miller, *PA B '04*

Susan P. Porzelius, *TN B '65*  
William F. Spurgeon, *TN B '65*

Anastasia M. Rynearson, *IN A '16*  
Lee K. Rynearson, *IN A '16*

Julian C. Salazar, *CA AA '18*  
Stephanie K. Salazar, *CA AA '18*

Margaret B. Tillman, *AL Δ '90*  
Mark Tillman, *AL Δ '90*

Catherine M. White, *MI Γ '99*  
Michael D. White, *MI Γ '99*

### Siblings

The Alhumaidi Brothers  
Ali, *CA AA '10*  
Jasem, *CA AA '18*

The Althouse Brothers  
Douglas G., *VA B '78*  
David W., *VA B '83*

The Armbruster Siblings  
Marie E., *TN B '18*  
Steven J., *IN A '20*

The Ashcraft Twins  
Jonathan S., *ID Δ '19*  
Nathaniel R., *ID Δ '19*

The Atkinson Siblings  
Brooke M., *NY Θ '19*  
Kevin O., *NY Θ '20*

The Auyeung Twins  
Kelsey, *MA B '19*  
Kris L., *MA B '19*

The Balma Brothers  
James P., *NJ Γ '72*  
Peter M., *NJ Γ '75*

The Basch Brothers  
Alan L., *FL A '57*  
Edward F., *FL A '62*

The Bellows Twins  
Allison R., *RI A '19*  
Jessica A., *RI A '19*

The Benigni Brothers  
Todd M., *MI Γ '95*  
Scott T., *MI Γ '98*

The Bergin Brothers  
Jameson S., *NH A '94*  
Jonathan M., *NH A '96*



The Bethards Brothers  
Kelby F., *IA A '94*  
Jared M., *IA A '98*

The Bhatia Siblings  
Sunita K., *DE A '92*  
Surita R., *DE A '95*  
Sujata K., *DE A '99*  
Krishan K., *DE A '00*

The Blasingame Brothers  
†Robert C., *PA B '39*  
†Benjamin P., *PA B '40*

The Bloomberg Brothers  
Jeffrey A., *MA E '86*  
Mark E., *MA H '88*

The Bollo Brothers  
Joseph A., III, *MI A '18*  
Noah J., *MI A '20*

The Brammer Brothers  
Gary M., *TX H '72*  
Steven R., *TX H '74*

The Braunagel Brothers  
Magnus V., *IN A '56*  
Robert C., *WY A '70*

The Brazhkina Sisters  
Maria V., *AR A '09*  
Olga V., *AR A '19*

The Brown Twins  
Aaron L., *RI A '19*  
Reed L., *RI A '19*

The Brown Twins  
Andrew, *CA M '20*  
Steven C., *CA M '20*

The Carrier Brothers  
Brian L., *IA A '18*  
Brett J., *IA A '20*

The Casella Sisters  
Anna A., *OH K '13*  
Alena, *OH K '17*

The Cieslak Brothers  
Daniel J., *IN Γ '96*  
David A., *IN Γ '04*

The Cole Twins  
Priscilla, *MA A '18*  
Richard P., *MA A '18*

The Congdon Brothers  
Richard G., *MA E '68*  
James S., *MA E '71*

The Crimarco Brothers  
Thomas M., *NY O '19*  
Steven V., *NY O '20*

The Curlee Brothers  
†Neil J., *CO B '28*  
†Gene V., *CO B '32*

The Darrow Brothers  
Christopher M., *IL Δ '10*  
Benjamin L., *IL Δ '16*

The De Maio Twins  
Joseph A., *PA Z '75*  
Michael, *PA Z '76*

The Deckter Sisters  
Stephanie M., *NY T '01*  
Erika D., *NY Γ '02*

The DiFranceisco Brothers  
Joseph, *NJ E '18*  
Nicholas J., *NJ E '19*

The Disberger Brothers  
Jay A., *KS Γ '18*  
Jordan C., *KS Γ '19*

The Fendrick Sisters  
Tracy M., *IA A '05*  
Katherine R., *IA A '07*

The Folsom Brothers  
Steven H., *UT B '82*  
Brian J., *UT B '86*

The Forehand Brothers  
Brett R., *AL A '92*  
Scott M., *AL A '94*

The Forslund Twins  
Donald C., *NJ A '60*  
Robert P., *NJ A '60*

The Forsyth Brothers  
Arick C., *MA Θ '18*  
Fitzanthony S.R., *MA Θ '19*

The Frazee Siblings  
Neven M., *IN B '16*  
Marissa A., *IN B '19*

The Freeman Twins  
Daphne A., *NY Θ '20*  
Devin G., *NY Θ '20*

The Frohbach Brothers  
Hugh F., *MN A '48*  
†Louis A., *MN A '50*

The Galbreath Brothers  
Christopher J., *MO E '17*  
Ian M., *MO E '19*

The Gluszak Brothers  
Paul H., *MI Δ '84*  
Timothy J., *NY N '88*

The Grandey Brothers  
Loren F., *OH Γ '40*  
Max F., *OH Γ '43*

The Guerin Siblings  
Lorraine, *WI A '16*  
Thomas, *WI A '19*

The Hagberg Brothers  
Paul A., *IL A '84*  
Daniel S., *IL A '88*

The Halac Brothers  
Kent E., *MI A '92*  
Alan E., *MI A '93*

The Hamburger Twins  
Jason D., *AZ Δ '19*  
Jonathan M., *AZ Δ '19*

The Hendela Brothers  
Edward A., *NJ Γ '75*  
Arthur, *NJ Γ '81*

The Herkenham Twins  
Joseph P., *NY Γ '80*  
William H., *NY Γ '80*

The Hernandez Twins  
Christian A., *IA A '19*  
Christopher I., *IA A '19*

The Isopi Brothers  
Dominic J., *MI E '16*  
Vincent P., *MI E '18*

The Jones Brothers  
Jared T., *OR Δ '14*  
Brayden J., *OR Δ '18*

The Kaczorowski Siblings  
Kelsie J., *TX A '07*  
Kevin J., *TX A '10*

The Kalin Twins  
Tabitha A., *CO A '18*  
Tiffany R., *CO A '18*

The Karnauch Brothers  
David P., *TN Z '15*  
Andrey P., *TN A '18*

The Kobus Siblings  
Chris J., *MI Θ '92*  
Jack M., *MI Γ '93*  
Catherine M. White, *MI Γ '99*

The Kogut Brothers  
James R., *MA E '71*  
Daniel R., *MA E '73*

The Kolodziej Brothers  
Justin A., *WI B '01*  
Kevin W., *WI Δ '07*

The Komar Sisters  
Franziska, *NJ A '19*  
Sandra, *NJ A '19*

The Lenczycki Brothers  
Christopher T., *AZ A '86*  
David T., *AZ B '95*

The Locker Brothers  
Robert J., II, *NY Σ '14*  
Sean T.R., *NY Σ '15*

The Lombardi Brothers  
Frank A., *NJ Γ '11*  
John T., *NJ Γ '16*

The Loos Brothers  
William A., *MO B '17*  
Dalton T., *MO B '19*

The Martonosi Sisters  
Margaret R., *NY Δ '86*  
Susan E., *NY Δ '98*

The Matta Siblings  
Maher S., *MA Θ '88*  
Juliana S., *MA Θ '90*

The Mauser Twins  
John F., *MD B '88*  
Joseph D., *MD B '88*

The Munch Brothers  
Paul R., *CO B '82*  
Mark R., *CO B '84*

The Newberger Brothers  
Barry S., *PA Γ '67*  
Edwin G., *PA Γ '68*

The Nguyen Brothers  
Thinh N., *WI A '01*  
An N., *WI A '01*

The Nysetvold Brothers  
Thomas T., *UT B '13*  
Timothy B., *UT B '18*

The Oliphant Brothers  
Kerry N., *UT B '88*  
Travis E., *UT B '95*

The Oppenheimer Brothers  
Edgar D., *NY A '45*  
Frank W., *NY A '48*



The Petreaca Brothers  
Nathan, *CA A '19*  
Ian A., *CA A '19*

The Pinkerton Brothers  
†Veral, *AR A '57*  
William E., *AR A '59*

The Plude Brothers  
Christopher J., *MI B '83*  
Curtis J., *IN A '85*

The Quisenberry Brothers  
Steve L., *TN A '68*  
David O., *TN A '72*

The Rickerl Brothers  
Paul G., *IA A '81*  
Ted L., *IA A '88*

The Rinne Brothers  
†John E., *CA A '31*  
†Clarence E., *CA A '35*

The Rouse Twins  
Aaron L., *AK A '19*  
Benjamin T., *AK A '19*

The Rueter Brothers  
Gary D., *MO B '66*  
Donald A., *MO B '71*

The Sanders Brothers  
Dylan N., *AK A '18*  
Robert T., *AK A '19*

The Santaiti Brothers  
Vincent, *NJ A '97*  
Eric, *NJ A '00*

The Scaplen Twins  
Kyle R., *MA A '18*  
Thomas M., *MA A '18*

The Scheffel Siblings  
Andrew J., *IL A '12*  
Kera N., *IL A '15*  
Kyle P., *IL A '15*

The Shearer Brothers  
Callum L., *CA A '17*  
Brodie M., *CA A '18*

The Sakalaukus Brothers  
James R., *AL A '10*  
Peter J., *AL A '11*

The Slawson Siblings  
Steve E., *TX A '87*  
Susan E., *TX A '89*

The Smith Brothers  
Douglas B., *KS A '55*  
Donald D., *KS A '56*

The Steadman Brothers  
Bryan L., *UT A '68*  
Bruce W., *UT A '72*

The Stellabotte Brothers  
John C., *NY A '90*  
Robert A., *NJ A '92*

The Streets Brothers  
Bradley K., *KS A '84*  
Jeffrey L., *KS A '86*

The Studer Brothers  
Benjamin D., *KS A '18*  
Jacob H., *KS A '19*

The Tostanoski Brothers  
Nicholas J., *NY A '18*  
Alex T., *NY A '19*

The Thibeaux Brothers  
Jerome F., *LA A '68*  
†John M., *LA A '72*  
Patrick F., *LA A '74*

The Tietjen Twins  
Donald L., *TX A '71*  
James L., *TX A '71*

The Treinen Sisters  
Michelle A., *CA A '98*  
Marissa H., *CA A '00*

The Verdoorn Brothers  
Brandon P., *WI A '04*  
Jared T., *WI A '05*

The Visintainer Brothers  
David A., *MO A '71*  
Alan D., *MO A '72*

The Wauford Siblings  
Rebecca E., *TN A '16*  
Samuel M., *TN A '19*

The White Twins  
Berkley, *KS A '19*  
Brianna M., *KS A '19*

The Wickline Sisters  
Elizabeth D., *WV A '10*  
Mariah M., *WV A '19*

The Wing Brothers  
Jack, *CA A '51*  
Jimmie, *CA A '52*

## Multi-Generation

### The Abate Family

†John E., *NJ A '54*  
Mark J., *NJ A '84*  
Holly A., *NJ A '92*

The Andrichak Family  
Stephen M., *PA A '58*  
Christopher S., *PA A '95*

The Angyal Family  
Stephen, *NJ A '63*  
Matthew S., *MD A '91*  
Nikolas M., *NY A '19*

The Ankrom-Comisar Family  
Linda S., *OH A '79*  
Wendy B. Comisar, *OH A '02*

The Aufderheide Family  
Greg A., *IN A '90*  
Justin, *AL A '19*

The Bassett Family  
†Preston R., Sr., *NY A 1913*  
†Preston R., Jr., *NY A '51*

The Beardmore Family  
†John W., *OH A '52*  
Marc R., *OH A '94*

The Behrendt Family  
John M., *WI A '80*  
Benjamin J., *IA A '12*  
Zachary J., *IA A '16*  
Jacob M., *IA A '18*

The Benig Family  
Vincent R., *IL A '93*  
Lily F., *IL A '19*

The Berdanier Family  
Barry N., *OH A '79*  
Bruce W., *SD A '80* (brother)  
Reid A., *NY A '10*

The Brenna Family  
Patricia M., *CT A '81*  
Daniel J., *NY A '13*

The Buffi Family  
James A., *MA A '77*  
James H., *IN A '08*  
Jenna R., *SC A '11*

The Caudle Family  
Hassell K., *TN A '00*  
Seth A., *TN A '19*

The Clinton-Jackson Family  
Daniel D. Clinton, Jr., *TX Δ '52*  
Charles W. Jackson, *MA B '79*  
Mary K. Jackson, *TX Δ '83*  
Charles W. Jackson, V, *VA B '13*

The Dague Family  
Edward L., *IL Z '95*  
Megan E., *IL Z '19*

The Dekalb Family  
Shawn W., *VT B '85*  
Carisa A., *VT B '19*

The Deschere Family  
†Allen R., *MA A '38*  
Mark R., *MI Γ '70*  
Bruce R., *MI Γ '73*  
Cristina M. Sircar, *MA B '07*  
David S., *MD B '82*

The Dowdle Family  
Walter L., *MS A '67*  
John R., *TX A '02*

The Duncan Family  
George I., *MT A '50*  
Stephen F., *IN B '71*

The Feisel Family  
Lyle D., *IA A '61*  
Patricia L. Cargill, *IA A '80*  
Margaret A. Craig, *IA A '83*

The Ferris Family  
Michael J., *OH B '64*  
Molly A., *PA A '88*

The Field Family  
†Herbert C., *OH A '53*  
Carla Roberts, *MD B '82*  
Dara, *PA H '86*

The Field Family  
Marshall L., *GA A '69*  
John M., *IN A '01*

The Gearhiser Family  
†William P., *MS A '31*  
William H., *MS A '69*

The Gilbert-Willson Family  
†William F. Gilbert, *MI B '45*  
Vernon R. Willson, *MI B '64*  
(son-in-law)  
Natalie I. Willson, *AZ Γ '92*  
(daughter-in-law)  
Samantha McNicholas, *WA B '18*

The Gustafson Family  
Molly B., *CO B '85*  
Eric G., *IN Δ '93*

The Haberkorn Family  
John J., *WI B '82*  
Cody M., *WI B '17*  
Luke M., *WI B '18*  
Kyle M., *WI B '18*

The Hashemian Family  
Hashem M., *TN A '80*  
Alexander H., *TN A '12*

The Heausler Family  
Thomas F., *LA B '81*  
Peter A., *LA E '19*

The Hegab Family  
Hisham E., *LA Γ '89*  
Rachel A., *LA Γ '19*

The Hixon Family  
†Charles W., *TX H '63*  
Charles T., *TX H '92*

The Hladik Family  
Jill M., *NY M '84*  
Stephen M., *NY M '85*  
Christopher H., *NY Γ '13*  
Lisa C.H., *NY M '19*

The Hnida Family  
Edward J., *OH A '85*  
Raianna M., *OH A '16*

The Holtslander Family  
Craig A., *MD Γ '90*  
Thomas A., *AL A '19*

The Homburger Family  
†Wolfgang S., *NY I '50*  
Paul A., *CA A '83*

The Hu Family  
Sung C., *CA Γ '65*  
Alison L., *CA Γ '96*

The Huffer Family  
Rebecca E., *VA B '90*  
Emily, *SC A '19*

The Jewett-DeYoung Family  
†Richard L., *IA B '34*  
John H. DeYoung, *VA A '99*

The Johnson Family  
Richard A., *CO B '67*  
Christopher B., *NY K '95*

The Jordon-Braunsdorf Family  
Walter M., *NJ B '41*  
Lorraine A. Braunsdorf, *NY Γ '83*  
Timothy Braunsdorf, *MA Z '18*

The Kasen Family  
Jon E., *MI B '88*  
Erika L., *IN E '19*

The Klopfenstein Family  
Rex C., *CT B '59*  
Mark W., *VA A '88*

The Kohman Family  
†Girard T., *KS A 1920*  
Wayne E., *KS A '51*

The Kropp Family  
Peter K., *IN A '69*  
Nathan P., *OH Z '96*

The LaBerge Family  
E.F. Charles, *MD A '74*  
Kelsen E., *OH I '04*

The Ladd Family  
Andrew R., *IL A '84*  
Adam C., *IL A '19*

The Ladd Family  
†Charles C., III, *MA B '55*  
Charles C., IV, *MA E '79*

The LaMastro Family  
Robert A., *NJ B '79*  
Veronica M., *NJ E '19*

The Lenthe Family  
Theodore V., *PA A '75*  
Alice E., *PA A '78*  
Elisabeth L., *PA B '08*

The MacDonald Family  
†Bryce I., *NY Δ '45*  
Craig M., *MI E '84*

The Maloney Family  
John M., *IN Γ '59*  
John M., *MD B '99*

The Masser Family  
Keith E., *PA B '73*  
David E., II, *PA A '93*

The Mauser Family  
Joseph M., *NM A '89*  
Ava, *NM B '18*

The McBeath Family  
†William K., *MS A '48*  
William K., Jr., *MS A '72*

The Fisher-Mettler Family  
Cynthia A. Fisher, *WA B '79*  
Todd E. Fisher, *WA B '79*  
Rick A., *WA B '81*  
Kelly M., *CA Δ '10*

The Modeer Family  
†James R., *CO B '53*  
Tracy L., *CO B '86*

The Moretti Family  
†Vincent C., *CA Δ '62*  
Vincent C., Jr., *CA Δ '78*

The Ness Family  
Joel K., *IA A '92*  
Stephanie K., *ND B '18*  
Eric C., *ND B '20*

The Novak Family  
†Anthony L., *IL B '55* (grandfather)  
Joseph W., *IN A '91*

The Overbeck Family  
Lori A., *MI I '84*  
Sarah I., *MI I '19*

The Piacsek-Ropella Family  
Kristina M. Piacsek-Ropella, *WI B '85*  
Kathleen M., *WI B '12*  
Mark P., *WI B '14*  
Dominick S., *WI B '18*

The Porzelius Family  
†Albert F., *MO A 1909*  
Susan P. Porzelius, *TN B '65*  
William F. Spurgeon, *TN B '65*

The Priest Family  
James L., *NH A '64*  
Anthony J., *GA A '88*  
Thomas J., *GA A '94*

The Prudich Family  
†Anton, Jr., *VA B '39* (uncle)  
Michael E., *WV A '74*  
Darryl E., *MI I '05*

The Rabideau Family  
Daniel J., *NY Δ '90*  
Megan J., *MA Δ '16*

The Rase Family  
†Howard F., *TX A '42*  
Howard F., *TX A '86*

The Rawlins Family  
Kristi A., *MO B '94*  
Charles H., *MO B '08*  
Charles C., *MT B '19*

The Reed Family  
Henry M., II, *SC I '60*  
Henry M., III, *SC I '85*

The Rinne Family  
Paul S., *CO Δ '74*  
Adam M., *AZ A '06*

The Sandberg Family  
Stuart D., *IN A '84* (uncle)  
Mariah R. Lafond, *TN A '19*

The Sander Family  
Wendell B., *IA A '56*  
Brian L., *IA A '85*

The Sartor Family  
†Thomas F., *TX B '50*  
Cynthia A. Lynch, *CO Δ '75*

The Satzler Family  
Larry V., *KS I '87*  
Josiah W., *KS I '20*

The Schweizer Family  
†Charles B., *LA A '36* (grandfather)  
Robert C. Vangiessen, *GA A '90*  
Charles B., *MO I '00*

The Shuler Family  
Michael L., *IN I '69*  
Jeremy S.L., *NY Δ '20*

The Sigworth Family  
Harrison W., Sr., *CA B '44*  
Harrison W., Jr., *OR A '68*

The Silvasi Family  
John J., *PA Z '70*  
Gabriel J., *PA Δ '93*

The Skinner Family  
Albert M., *DE A '51*  
†Mark W., *DE A '81*

The Skrovanek Family  
Stephen D., *PA B '74* (uncle)  
David J., *PA A '19*

The Smith Family  
Donald B., Jr., *PA I '91*  
Eric C., *PA I '15*  
Gregory M., *PA I '16*

The Sorooshian Family  
Soroosh, *AZ B '85*  
Armin, *AZ A '03*

The Spradlin Family  
Louis W., *MA B '57* (grandfather)  
Alexandria A., *FL I '16*  
Katrina N., *FL I '18*

The Strong Family  
Beeman E., III, *TX A '59*  
Beeman C., *TX A '95*

The Tartanian Family  
Charles N., *NY Z '58*  
Gary C., *MD B '83*

The Torgesen Family  
Greg L., *UT I '80*  
David A., *UT I '10*  
Matthew G., *UT I '12*

The Triolo Family  
Anthony A., *NJ I '91*  
Emily R., *NJ Z '19*

The Tuthill Family  
†Arthur F., *VT A '38* (grandfather)  
Andrew R., *VT A '86*

The Valent Family  
Philip J., *IL B '63*  
Philip S., *MD I '90*

The Van Wieren Family  
†Ewald T., *MI Z '47*  
Ronald L., *MI B '71*  
Steven M., *MI A '74*

The Varney Family  
Victor, *TN B '79*  
Trevor S., *NC A '19*

The Wakim Family  
Sana T., *CA Θ '82*  
Mona H., *MA Θ '86* (niece)  
Rachel E., *MA Θ '10* (niece)  
Joseph, *MA Θ '19*

The Wolf-Jewell Family  
Thomas F., *WI B '59*  
Leonard J. Jewell, *MN A '92*  
Emily A. Jewell, *WI A '17*

The Wong Family  
Richard C., *CA A '53*  
Brian P., *CA E '82*

The Zipf Family  
Peter J., *NY E '79*  
Elizabeth A., *LA B '13*

The Zwahlen Family  
†Helmut T., *OH Δ '62* (great uncle)  
Zachary J., *OH Δ '15*



## **Thomas R. Berthold, IL Alpha 1970 On Supporting the Scholarship Program**

**“We need good engineers to make our technological future better, including addressing social issues like power and clean water in developing countries. Tau Beta Pi encourages excellence in engineering and the scholarships are a small way of rewarding dedicated students. That is why I decided to partner with Tau Beta Pi in support of this Program.”**

*In 2018, Tau Beta Pi awarded 31 Fellowships and a record number of 288 Scholarships, the majority being funded by gifts from individual alumni.*

**Undergraduate Scholarships:** \$2,000 gift—one year award | \$40,000 gift—permanently funds one scholarship.

**Graduate Fellowships:** \$10,000 gift—one year award | \$200,000 gift—permanently funds one fellowship.

**For more information about establishing a Fellowship or Scholarship, please contact Sherry Jennings-King, TN A '93, [sherry.jenningsking@tbp.org](mailto:sherry.jenningsking@tbp.org) or 612/226-2922.**



## ALUMNI NOTES

### Alabama Delta

**J. Larry Leopard, '87**, has been appointed director of the engineering directorate at NASA's Marshall Space Flight Center in Huntsville, AL. He joined NASA in 1990. The directorate is responsible for design, testing, evaluation, and operation of flight hardware and software associated with space systems in development at Marshall.



### Arizona Alpha

**David J. Soukup, P.E., '76**, has been named a Fellow of the American Society of Mechanical Engineers. He marked his 30th year on the staff of ASME in October 2018. Soukup currently serves as managing director, governance. He is also an adjunct professor in the department of technology management and innovation at New York University's Tandon School of Engineering. He was Assistant Secretary-Treasurer of TBPI from 1976-84.



### Colorado Zeta

**Col. Timothy M. Cullen, Ph.D., '94**, has received an NCAA Silver Anniversary Award recognizing his collegiate and professional achievements. He was a fencing student-athlete at the U.S. Air Force Academy, an NCAA All-American, and recipient of the 1994 NCAA Postgraduate Scholarship. Cullen now serves as



director of safety for Pacific Air Forces based at Joint Base Pearl Harbor-Hickam in Honolulu. He was previously commandant and dean of the School of Advanced Air and Space Studies at Air University on Maxwell AFB in Alabama.

### Florida Zeta

**Nancy J. Walker, '83**, has joined inflight connectivity company SmartSky Networks as chief commercial officer. She was recently profiled by *Runway Girl Network* on engineering and integrity. During her 30-year electrical engineering career, she's worked on commercial and military communications programs, and has run her own entrepreneurial consumer businesses, while also raising two children.



### Iowa Alpha

**M. Dudley Bonte, P.E., '71**, of Martinsville, IN, was inducted into the Asphalt Pavement Association of Indiana (APAI) Hall of Fame at its annual conference and trade show in Indianapolis. He spent 40 years with Rieth-Riley Construction Co., Inc., retiring as regional quality control director, and serving as a director for his last seven years. After a brief retirement, Bonte served three years as technical director for APAI where he retired in 2017.



### Louisiana Beta

**Thomas F. Heausler, '81**, is a structural engineer with over 37 years' experience and has been advanced to fellow status by the American Society of Civil Engineers (ASCE).

He was co-founder of the Structural Engineers Association of Kansas and Missouri; a grader of national structural engineering exams; adjunct instructor at the University of Missouri-Kansas City; and expert witness in legal matters. Heausler founded Heausler Structural Engineers-Kansas City in 1995 and currently serves as an independent structural engineer.



### Maryland Beta

**Darryll J. Pines, Ph.D., '86**, has been elected to the board of trustees of global safety and certification consultants Underwriters Laboratories, Inc. (UL). He is dean of the University of Maryland school of engineering and previously served as program manager for the tactical technology office and defense sciences office at DARPA.



### Massachusetts Zeta

**Diane W. Morabito, P.E. '81**, is the new vice president of traffic engineering at James W. Sewall Company. Most recently, Morabito was founder of Maine Traffic Resources. That company and Sewall had already won a contract on a project described as the most extensive traffic engineering and infrastructure rehabilitation development in Maine's history as part of a team effort.



### New York Eta

**Ronald S. Kane, Ph.D., P.E., '65**, retired from New Jersey Institute of Technology in 2011 and is NJIT's first dean of graduate studies emeritus. He and his wife Susan celebrated their 50th wedding anniversary in 2018 with three generations of their family at Disney World. They continue to travel the entire world, already having visited all 50 states, all seven continents, and over 100 countries.



### North Carolina Epsilon

**Christopher A. Belton, '07**, received the Admiral Michelle Howard Legacy Award at the annual Black Engineer of the Year Award Stem Global Competitiveness Conference. He is a lead test engineer at Newport News Shipbuilding.



**David L. Rhodes, '04**, is one of four engineers at the Naval Undersea Warfare Center in Newport, RI, named winners in the Science, Technology, Engineering and Math (STEM) Achievement Awards. The awards are made by *U.S. Black Engineer and Information Technology* magazine and the Council of Engineering Deans of the Historically Black Colleges and Universities. Rhodes, a software engineer, was recognized for many contributions during his 16-year career at NUWC Newport.



### Ohio Gamma

**Kathryn W. Jablokow, Ph.D., '83**, is recipient of the 2018 Penn State Engineering Alumni Society World-Class Engineering Faculty Award in recognition of her teaching, research, and service. She is

a professor of engineering design and mechanical engineering, and associate chief academic officer at Penn State Great Valley. Jablokow was praised for her role in establishing the B.S. engineering degree with a multidisciplinary engineering design option.



### Puerto Rico Alpha

**Denny Cruz-Acevedo, '85**, has fulfilled his dream of retiring at an early age to follow his passion as an artist. He continues to create art to benefit children's charities. His 32 year chemical engineering career with the Environmental Protection Agency (EPA) included the Office of Solid Waste and Office of Water. He helped to devise medical waste regulations for Puerto Rico and worked with the government of Thailand to develop environmental impact assessments.



### Texas Delta

**Gayle J. Gibson, '83**, has been elected as an independent director of the board at Aqua Metals, Inc. She has 34 years of engineering and executive experience at DuPont and will assist moves to commercialize Aqua Metal's proprietary AquaRefining™ electrochemical lead recycling technology. Gibson served in many roles at DuPont, including as chief of staff and director of engineering.



### Virginia Beta

**Richard M. Bembem, '04**, has been elected as a director of Sterne, Kessler, Goldstein & Fox, an intellectual property spe-



cialty law firm. His practice focuses on matters before the U.S. Patent and Trademark Office. Bembem's bachelor's and master's degrees in engineering are from Virginia Tech.

### Washington Gamma

**John D. Hooper, P.E., '81**, has been named as engineer of the year by the American Council of Engineering Companies of Washington. He is director of earthquake engineering at Seattle-based Magnusson Klemencic Associates (MKA). According to the announcement, Hooper has worked on more than 100 projects at MKA.



### Wyoming Alpha

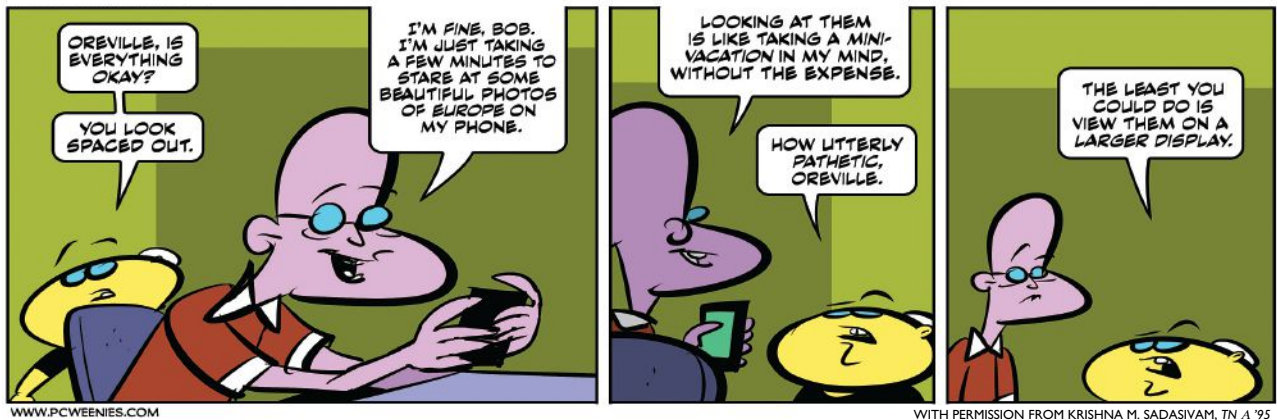
**Patrick T. Tyrrell, P.E., '79**, has retired as state engineer and chief water official for Wyoming, a post he has held since 2001. During his tenure, Tyrrell dealt with compliance to the 2001 Modified North Platte Decree, the Coalbed natural gas boom, numerous Colorado River agreements, and served through the entirety of the 11-year United States Supreme Court lawsuit with Montana over the Yellowstone River Compact.



## Write Your Own 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, P.O. Box 2697, Knoxville, TN 37901-2697 or to [alumnote@tbp.org](mailto:alumnote@tbp.org). Material for publication must be received for the **Spring** issue by February 1, **Summer** issue by May 1, **Fall** issue by August 1, and **Winter** issue by November 1. Include name, address, chapter, class year, and email address or phone number. Thank you!

## The PC Weenies



WWW.PCWEENIES.COM

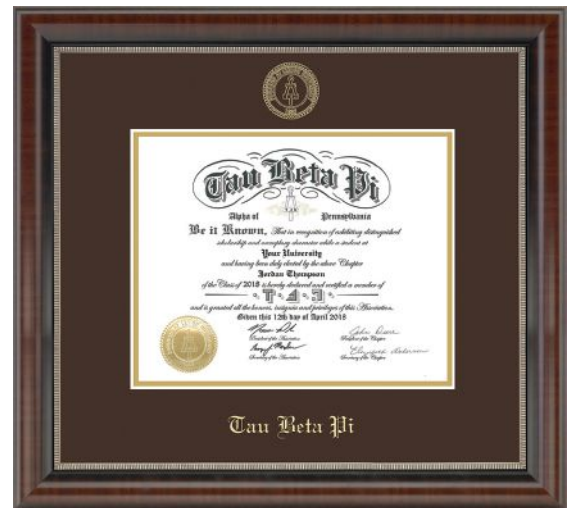
WITH PERMISSION FROM KRISHNA M. SADASIVAM, TN A '95

## You Could Be Framed!

### Member Benefits

SEE COMPLETE LIST at [tbp.org/memb/benefits.cfm](http://tbp.org/memb/benefits.cfm)

- **GEICO**—additional discounts on automobile insurance.
- **LinkedIn**—join 27,500 members in our official group for professional networking and career discussions (search: Tau Beta Pi Engineering Honor Society).
- **Local Hospitality**—access to a worldwide inventory of hotels at exclusively discounted rates.
- **TBP4Life**—a private community mobile app and web platform for mentoring & networking opportunities [[tbp.vineup.com/](http://tbp.vineup.com/)].
- **SIRVA Home Benefits**—discounts on real estate, mortgages, and moving services.
- **PPI**—discounts on professional licensing exam review materials (FE/EIT, PE, & more).
- **TBP Job Board**—post a resume online and browse through hundreds of engineering jobs at top companies.



Our NEW official certificate frames from Churchill Classics feature the Association's name and Bent in a gold emboss on a high-quality wood moulding. Each frame includes instructions to hang your frame to professional standards. Your personalized certificate includes your name, chapter, class, initiation date, and chapter officers' signatures at the time of your initiation.  
 PRICES: Frame & Certificate—\$160; Frame Only—\$150; Shipping—\$15.00.

### CHANGE OF ADDRESS THE BENT

Name \_\_\_\_\_ Chapter \_\_\_\_\_ Class \_\_\_\_\_  
 New Address \_\_\_\_\_ Effective date of new address \_\_\_\_\_  
 New City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_ Email \_\_\_\_\_

Email information to: [member.update@tbp.org](mailto:member.update@tbp.org)

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

### \$\$ Benefit for Members

*Members may be eligible for an additional discount off their automobile insurance.*

Did you know that GEICO provides a discount to Tau Beta Pi members on their auto insurance, which benefits Tau Beta Pi whenever a member gets a quote? Members could save up to an additional 8% on car insurance. Also, GEICO can help you find great insurance rates on motorcycle, homeowners, rent-

ers, boat, and much more. Get a free quote today to see how much you could save with GEICO. It will be a very wise decision! Visit <https://www.geico.com/landingpage/member-discount/?logo=17829> or call 1-800-368-2734 for your free quote.



Tau  
Beta  
Pi



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# TAU BETA PI STORE



- Discounts for Chapters
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[WWW.TBP.ORG/STORE](http://WWW.TBP.ORG/STORE)

# Tau Beta Pi

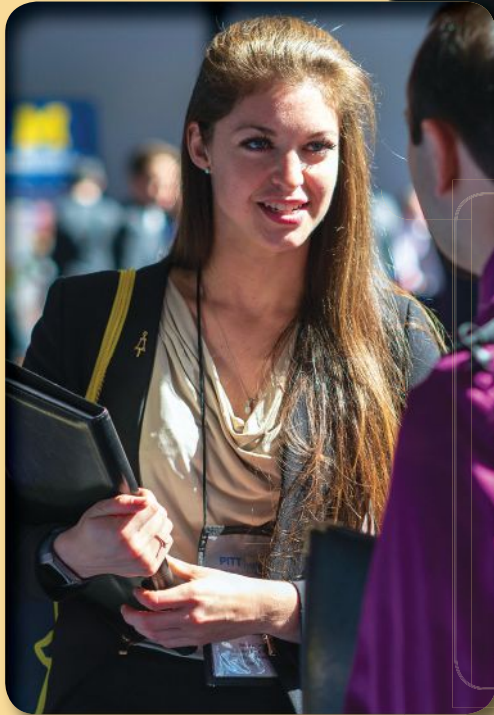
October 10-12

Columbus, Ohio

Airport Marriott

2019

## Convention



**RECRUIT** the best and  
the brightest and  
**SPONSOR** activities at the  
annual Tau Beta Pi Convention!



By participating in the Convention, you can showcase your company and gain national exposure among top engineering achievers and leaders.

### **Recruiting Fair – Friday, October 11**

As a member, you know that Tau Beta Pi are among the brightest and most talented engineers in the country. Your company will want a chance to hire more valuable employees like you!

Meet diverse candidates from 248 colleges and universities, most of whom hold leadership positions in their chapters.

Receive a DVD with resumes of nearly 1,500 TBPI students from most engineering curricula and computer science.

Corporate booth fees start at \$750 for Tau Beta Pi's Recruiting Fair. Visit [www.tbp.org/convention/careerFair.cfm](http://www.tbp.org/convention/careerFair.cfm).

### **Sponsorships**

Gain added visibility and speaking opportunities by sponsoring one of the Convention meals. Range is \$1,450 to \$15,000 (Banquets, Breakfasts, Lunches, Refreshment break).

Visit [www.tbp.org/convention/sponsorshipOpps.cfm](http://www.tbp.org/convention/sponsorshipOpps.cfm).

Through contacts by our member-employees, TBPI has formed relationships with companies like BAE Systems, FedEx, Northrop Grumman, Ramboll, Raytheon, Sandia, and Texas Instruments, who saw the value in hiring fellow members.

Contact Pat McDaniel at [pat@tbp.org](mailto:pat@tbp.org) for more info.