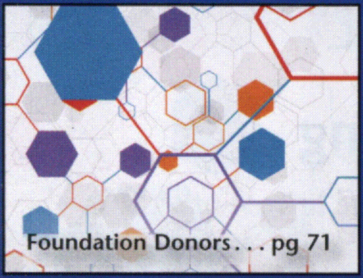
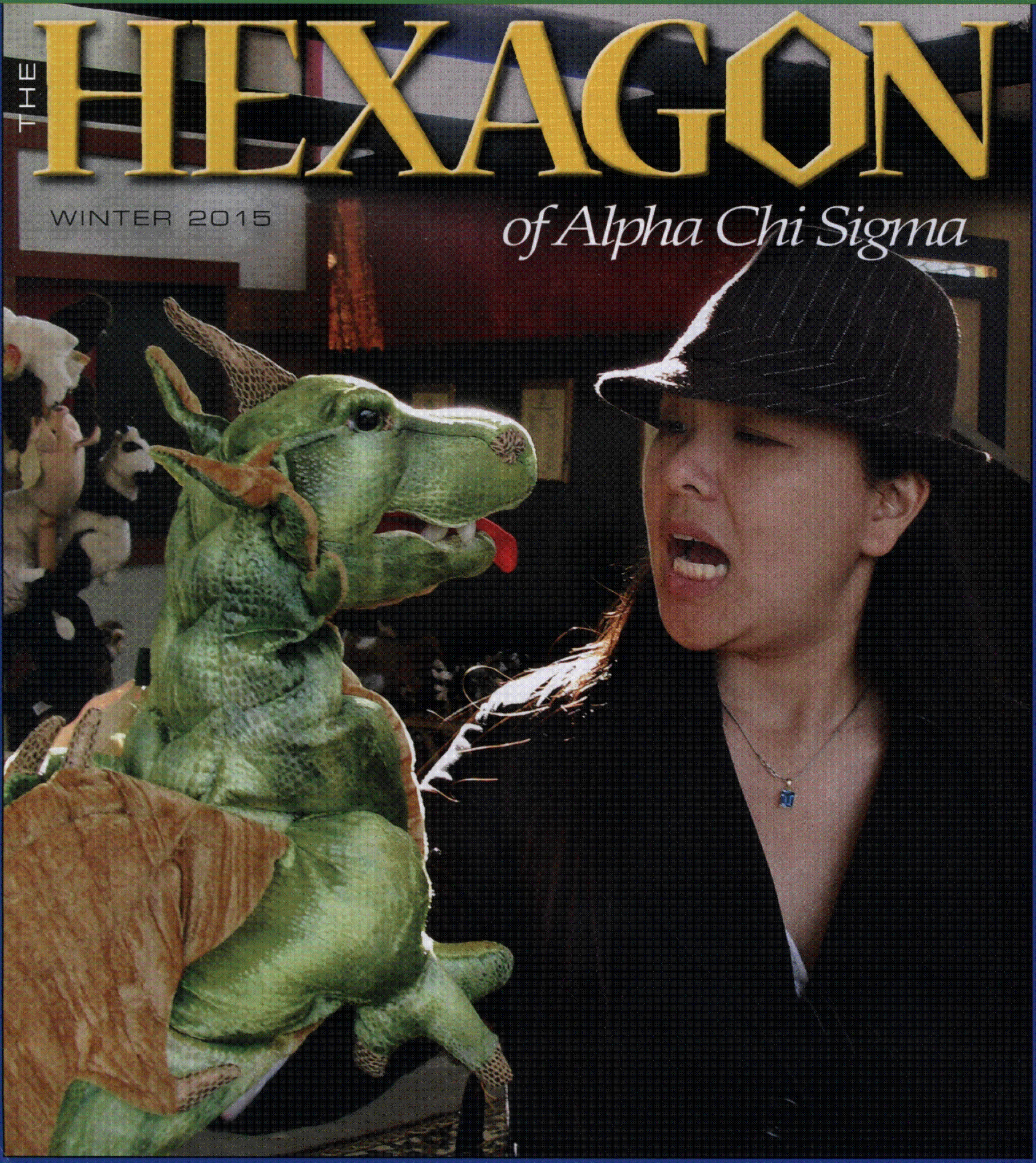



THE HEXAGON

WINTER 2015

of Alpha Chi Sigma



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Chapters and groups: Send stories of events, and don't forget photos. Send contact information as well.
Alumni: Personal and professional news is always welcome.

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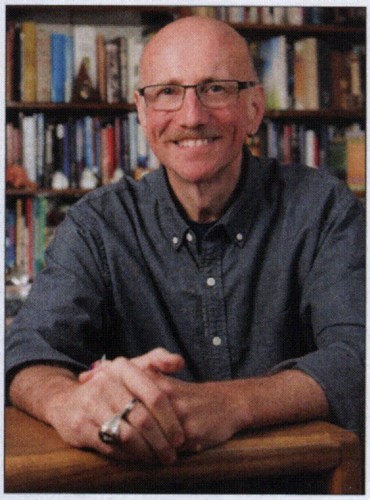
EDITORIAL

Leadership and Learning

"Leadership and Learning are indispensible to each other."
—President John F. Kennedy



Brian P. Coppola, GE, Alpha Beta 1988

Much can be said of leadership. Leaders inspire. Leaders pave the way. Leaders create opportunities that benefit others. Leaders know when to get out of the way.

A good leader also understands that a diversity of backgrounds and experiences brought into an organization helps to broaden the perspective of all its members, and in doing so it strengthens the organization. As President Kennedy so wisely noted, great leaders are also in a constant state of learning from those around them, gathering the information they need to make good and informed choices.

As is true for many complex organizations, Alpha Chi Sigma relies on a structure of chained leadership: of the individual members in service to the Objects, of committee members, of its officers, and so on, through the members of the Supreme Council.

Active members at the college level turn over rapidly, so one of the points of critical leadership rests with the chapter advisor, who can often be the one who not only carries the long-term residential memory of the chapter, but also serves as the liaison between the organization and the home institution.

According to the current census, there are 64 chapters and colonies listing 64 advisors. Of these individuals, 42 are tenure track professors, 11 are non-tenure track lecturers or adjuncts, 9 are staff members, 1 is in industry and 1 is a graduate student.

Is this mixture good or bad? I am somewhat biased, and freely admit to a preference for faculty members, whose natural state of mind is to be working with, and learning from, students. Clearly, there are other criteria, starting with the eagerness and willingness to serve in the role, and you cannot get everything you want wrapped in one package all of the time.

I am not at all critical of chapters that do not have faculty advisors, nor am I critical (at all!) of the great work that anyone does as an advisor, but I would still urge chapters to consider the question of their own leadership. In planning events and in promoting Alpha Chi Sigma, are members ensuring they are putting faculty members on their invitation lists, perhaps even identifying and lobbying individuals who really ought to know about the Fraternity and its activities?

There was no active chapter of Alpha Chi Sigma at my undergraduate alma mater while I was there. I was inducted by *Alpha Beta*, in 1988, when they asked me to be their chapter advisor. I stepped away in 1998 when I took over as editor of *The HEXAGON*, after which time my faculty colleague, Masato Koreeda, was inducted and served as advisor until his retirement, last year. And my junior faculty colleague, Bart Bartlett, is about to be inducted and will become the new chapter advisor this year. In all three cases, the membership played an important role in identifying and recruiting their new advisor.

Leadership and initiative have characterized the membership in our chapter, and it reminds me that everyone can take the chance of stepping up to a challenge, learning from those around them, and risking potential failure for the chance at success.

On the Cover

A brother from LA Pro faces down a (real, live) Wyvern at a Renaissance Festival. *Photo by Derek Marin.*

The Objects of Alpha Chi Sigma

1. To bind its members with a tie of true and lasting friendship.
2. To strive for the advancement of chemistry both as a science and as a profession.
3. To aid its members by every honorable means in the attainment of their ambitions as chemists throughout their mortal lives.

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Rediscovery of the Elements

The Rare Earths–The Confusing Years

A gallery of rare earth scientists and a timeline of their research

Figure 1. Important scientists dealing with rare earths through the nineteenth century. Johan Gadolin (1760–1852)[1g]—discovered yttrium (1794). Jöns Jacob Berzelius (1779–1848) and Martin Heinrich Klaproth (1743–1817)[1d]—discovered cerium (1803). Carl Gustaf Mosander (1787–1858)[1p]—discovered lanthanum (1839), didymium (1840), terbium, and erbium (1843). Jean-Charles deGalissard Marignac (1817–1894)[1o]—discovered ytterbium (1878) and gadolinium (1880). Per Teodor Cleve (1840–1905)[1n]—discovered holmium and thulium (1879). Lars Fredrik Nilson (1840–1899)[1n]—discovered scandium (1879). Paul-Émile Lecoq de Boisbaudran (1838–1912)—discovered samarium (1879) and dysprosium (1886).[1b] Carl Auer von Welsbach (1858–1929)[1c]—discovered praseodymium and neodymium (1885); co-discovered lutetium (1907). Eugène-Anatole Demarçay (1852–1903)—discovered europium (1901).[1e] William Crookes (1832–1919)[1m]—spectral techniques; proposed "meta-elements." Marc Delafontaine (1837–1911)—co-discovered holmium (1879). Charles James (1880–1928)[1k]—co-discovered lutetium (1907). Georges Urbain (1872–1938)[1k] —co-discovered lutetium (1907). Bohuslav Brauner (1855–1935)—predicted element 61.

Table 1: Crustal abundances of rare earths, ppm [ref 2]

Sc	Y	La	Ce	Pr*	Nd*	Pm	Sm	Eu	Gd	Tb**	Dy	Ho	Er**	Tm	Yb	Lu
22	33	30	60	8.2	28	trace	6	1.2	5.4	0.9	3.0	1.2	2.2	0.5	3.0	0.5

*Mosander's didymium was a mixture of Pr and Nd.

**Tb and Er are now reversed from the original assignments of Mosander.

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The rare earths after Mosander. In the previous *HEXAGON* "Rediscovery" article,[1p] we were introduced to the 17 rare earths, found in the f-block and the Group III chemical family of the Periodic Table. Because of a common valence electron configuration, the rare earths have similar chemical properties, and their chemical separation from one another can be difficult. From preparations of the first two rare earth elements—yttrium and cerium—the Swedish chemist Carl Gustaf Mosander (Figure 1, 2) was able to separate four additional elements during 1839–1842: lanthanum, didymium, erbium, and terbium.[1p]

Mosander's discoveries signaled the possibility of yet more elements hidden in the parent yttrium and cerium. However, it was three and a half decades before the next rare earth was isolated. Mosander's successes had been relatively "easy pickings," because abundant lanthanum (see Table 1) could be quickly and quantitatively separated as the soluble trivalent salt (La^{+3}) from insoluble tetravalent cerium (Ce^{+4}); and the vivid colors of didymium (amethyst), erbium (orange), and terbium (rose) allowed visual tracking of their separation during repeated recrystallizations. By contrast, the remaining rare earth oxides all generally exhibit the same valence state (+3), are colorless, and exist in low concentrations in nature.

The advent of spectroscopy. During 1860–1861 Robert Wilhelm Bunsen (1811–1899) and Gustav Robert Kirchhoff (1824–1887) of the University of Heidelberg discovered the elements cesium and rubidium (1860–1861) in Dürkheim Spa mineral waters with their newly invented emission spectroscope.[1h] This spectral tool was immediately adopted by William Crookes[1m] in London to discover thallium (1861) from Harz Mountain mines of Germany; and then by Hieronymus Theodor Richter (1824–1898) and Ferdinand Reich (1799–1882) of the Freiberg Mining School in Saxony to discover indium (1863) from the neighboring Himmelfürst Mine.[1a,h] Spectral analysis was quickly recognized as a possible solution to untangle the confusing rare earth mixtures. With the simultaneous development of more sophisticated chemical separation techniques, rare earth research experienced a surge during the last quarter of the nineteenth century.

Spectral analysis—the situation becomes complicated. One might expect that the new method of emission spectroscopy might prompt immediate discoveries of rare earths. Ironically, spectral analysis initially complicated the situation, because thousands of spectral lines now had to be separated and identified. These lines arose not only from mixtures of rare earths themselves, but also from many other elemental impurities such as iron, strontium, barium, etc., with which rare earths were chemically bound in the original minerals. Further complicating the situation, different source minerals would have different relative compositions of the rare earths (Figure 3), rendering corroboration difficult by others—it was even possible that a mineral specimen would be lacking one of the rare earths which would be present in abundance in a sample from a different geological site. Furthermore, different researchers would use different recrystallization conditions (concentration, temperature, etc.), resulting in subtle composition differences and different spectral appearances for the "same" element preparations. Announcements soon appeared of philipium, decipium, mosandrium, rogerium, glaucodymium, russium,[3a] carolinium, berzelium,[3c] celtium,[3e] denebium, dubhium, welsium,[3d] terbium-II and terbium-III, neoholmium and neo-erbium,[3d] thulium-II and thulium-III,[3e] etc., etc. Known rare earths with confusing manifold spectra led hasty chemists, eager to win the glory of new discoveries, to announce even more complex mixtures, e.g., Xα, Xβ, Xγ, Xδ, Xε, Xζ, Xη, in "element X" from samarskite (Figure 3); Erα and Erβ in erbium; Tmα and Tmβ in thulium; Smα and Smβ in samarium; and Diα, Diβ, Diγ, Diδ, Diε, Diζ, Diη, Diθ, and Diι in didymium![3a] In fact, during the half century after Bunsen and Kirchhoff's invention of the spectroscope, no less than ninety-four (94) spurious claims were made for new rare earths![5]

Sometimes, in the hands of two independent researchers, different but "similar" ele-

Figure 2. On the left is the building housing the Royal Swedish Academy of Sciences (second site), Wallingatan 2 (N59° 20.26 E18° 03.52), where Mosander lived and worked. Here he prepared lanthanum, didymium, erbium, and terbium.[1p] The building is now used for general offices. The church at the end of the street is Adolf Fredriks Kyrka [Church], inaugurated in 1774. The view looked the same in Mosander's time. "Father Moses," as Mosander was affectionately called by his friends, proudly told Berzelius (co-discoverer of cerium) that in this building was prepared the only pure sample of ceric oxide in the world — "white, slightly yellowish" (1842).[4]

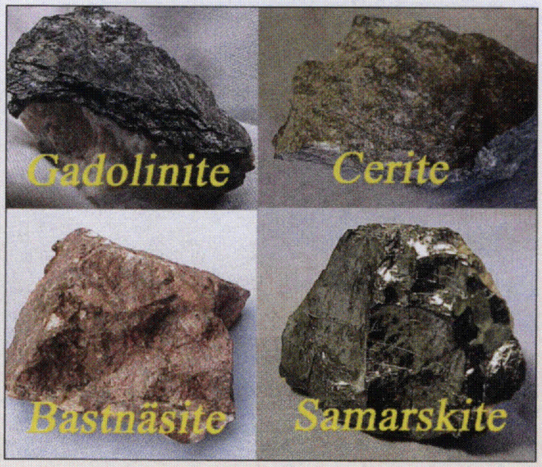


Figure 3. Historically important rare earth minerals. Gadolinite, $(Y,RE)_2FeBeSi_2O_{10}$, from the Ytterby Mine, Sweden; source of the first rare earth discovered, yttrium, and named for the element's discoverer, Johan Gadolin; analyzes (%) for Y/Tb/Tb/Dy/Tm/Yb 16/2/2/2/5/3. Cerite, $(Ce,RE,Ca)_{10}Fe(SiO_4)_6(SiO_3OH)(OH)_3$, from the Bastnäs Mine; source of the first lanthanide; by Klaproth, Hisinger, and Klaproth, analyzes (%) for La/Ce/Pr/Nd/Sm 12/26/3/11/2. Bastnäsite, $(RE)CO_3F$, the main source of rare earths both in the U.S. and China. This sample from Mountain Pass, CA, analyzes (%) for La/Ce/Pr/Nd/Sm 33/49/4/12/1. Samarskite $(RE,U,Th,Fe)(Nb,Ta,Ti)_5O_{16}$, resembling "black obsidian," has wildly variable compositions; this very radioactive sample from Jefferson County, CO, analyzes for (%) U/Th/Dy/Er/Yb/Lu 10/10/3/3/6/1.
All mineral photographs in these figures are taken of specimens in the private collection of the authors; all specimens possessed lesser (<1%) quantities of the remaining rare earths which are not listed.

Figure 4. Two unusual minerals illustrating that rare earth distributions can vary widely in nature. Left: Kuliokite (purple crystal), $(Y,RE)_4Al(SiO_4)_2(OH)_2F_5$, from the Kuliok River, Kola peninsula, Russia. The mineral has unusually high amounts of the "rarer" rare earths—(%) Y/Gd/Dy/Ho/Er/Tm/Yb/Lu 56/0.4/1.0/0.2/2.0/0.1/3.0/0.1. Right: Schuilingite (bluish coat), $PbCu(Nd,RE)(CO_3)_3 \bullet 1.5H_2O$, from Kasompi, Shaba, Zaire, a copper-rich district in Africa. The concentration of europium is incredibly high (europium is the red phosphor in color television screens)—(%) Y/Nd/Sm/Eu/Gd 14/12/8/7/13. Obviously, the mineral did not form by the ordinary volcanic or ion-adsorption geological mechanisms[1p] but instead by an unusual secondary hydrothermal process.

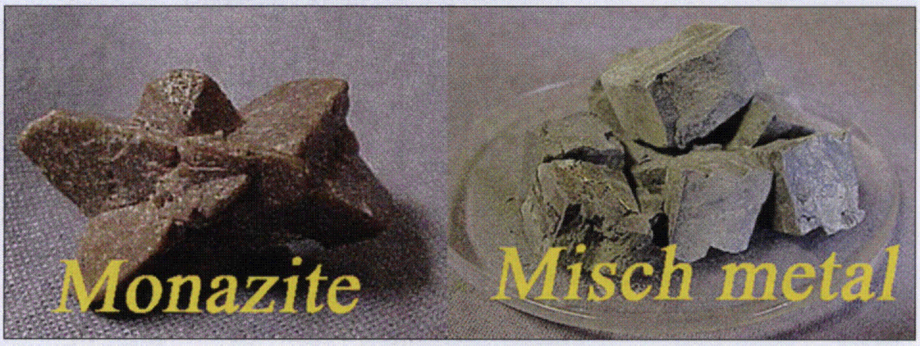


Figure 5. Monazite, $(RE,Th)PO_4$, was used extensively by Welsbach to develop his rare earth enterprises. He utilized the newly discovered monazite sands of Brazil; this crystalline sample from Minas Gerais, Brazil, illustrates the appearance before erosion to sand. "Misch metal," a crude mixture of the lighter rare earths (with admixtured iron to impart hardness), is pyrophoric and serves as the "flint" in cigarette lighters. The rare earth composition (%) of this sample is La/Ce/Pr/Nd/Sm 28/52/4/13/2.

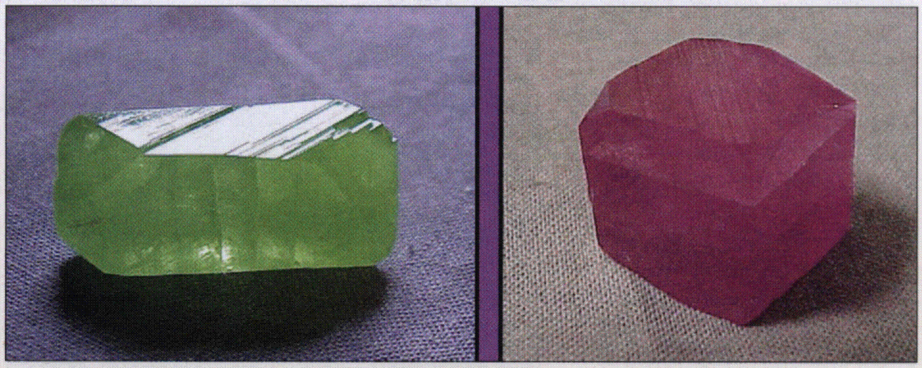


Figure 6. Crystals of praseodymium (green) and neodymium (magenta) sulfates. Neodymium has often been in the news lately, being an important ingredient in small permanent magnets which are critical in modern electronic devices. These mixed elements were considered a single element, called "didymium" by Mosander, before they were separated by Welsbach half a century later. Separating the two photographs in this figure is an amethyst-colored separator, the color of the didymium crystals collected by Mosander.[1p] Didymium safety glasses, with this same amethyst hue, are still being used by glassblowers and jewelers to filter out the blinding yellow glare of molten glass.

ments were recognized as being identical. An example was holmium,[4] which Delafontaine observed spectroscopically[5a] before Cleve isolated it.[6]

Although Delafontaine is not generally recognized as the primary discoverer of a rare earth, his imaginative analytical schemes were recognized as important in clarifying the situation. Before it was realized that the rare earth composition of different mineral specimens could be wildly diverse (Figure 4), there was a dispute regarding the nature, if not the existence itself, of Mosander's original erbium and terbium. Delafontaine produced definitive work that confirmed the existence of both, and to avoid confusion in the literature, he suggested (1877) a formal reversal of the original assignments of erbium and terbium by Mosander, which the scientific public accepted.[5a]

Advanced separation techniques. Realizing that the classical recrystallization techniques were inadequate for the job of separating the rare earths, investigators sought more advanced solvent/salt systems. One technique that proved to be particularly successful was the double salt method, whose first major success was the separation of the components of Mosander's didymium. It had been suspected that didymium was actually two elements, because samples of didymium from different geological sites might exhibit the same spectral lines, but with different intensity patterns—the prime example of this was seen with samarskite, notorious for its variable composition (Figure 3), studied by Delafontaine and Boisbaudran.[5a] The person to resolve this question was Welsbach, the inventor of the gas mantle and the cigarette lighter.[1c]

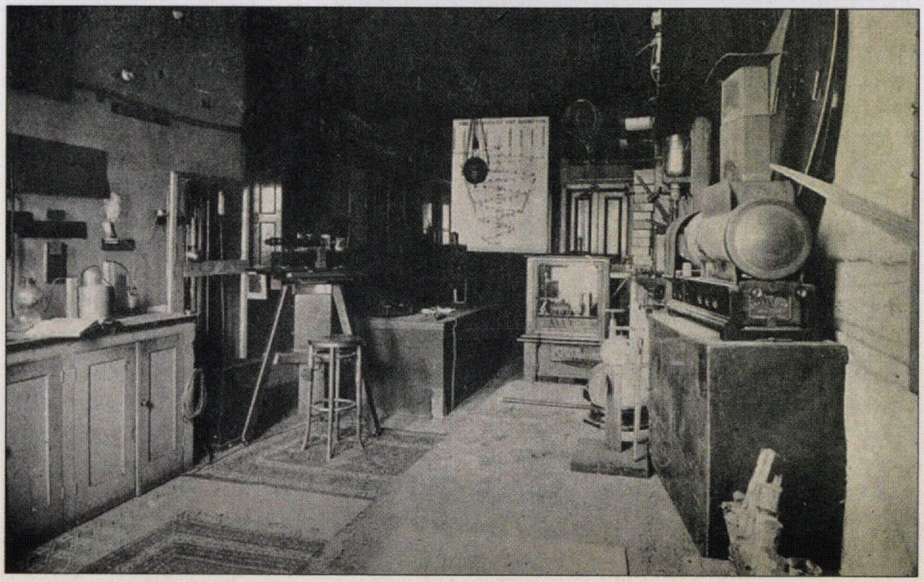
Welsbach procured monazite (Figure 5), originally used as a ballast for sailing ships, to obtain thorium. He impregnated lantern mantles with thorium oxide which glowed bright white when heated by a flame (Coleman gas lantern mantles purchased in the U.S. 15 years ago used thorium oxide, but now use yttrium oxide).

The remaining rare earths he called "Misch metal," a pyrophoric mixture for flints in cigarette lighters (which he also invented) (Figure 5). From Misch metal he isolated didymium and in 1885 was successful in separating its components—two elements which he called praseodymium ("green twin") and neodymium ("new twin") (Figure 6). For his solvent system, he used ammonium double nitrates $(RE)(NO_3)_3 \bullet 2NH_4NO_3$ in concentrated nitric acid[5b] ("RE" = rare earth element).

Other examples of new efficient separation schemes included those of Urbain, who used a

TOP RIGHT: Figure 7. Crookes moved to this house in 1880 at 7 Kensington Park Gardens in Notting Hill (N51° 30.69 W00° 12.16.) where he spent the remainder of his life. Crookes was never formally associated with any university; instead, he worked in his home and at the editor's office of his The Chemical News.

Figure 8. The laboratory inside Crookes home. It was here where terrestrial helium was first spectroscopically verified.[1n] *At the end of the laboratory is his spiral Periodic Table, prepared to show his theory of an electrical oscillation phenomenon that created the elements out of a primordial material. Crookes' imagination took him to many places, including spiritualism, which he seriously explored for a large portion of his life.*



combination of double magnesium nitrates $(RE)(NO_3)_3 \bullet 3Mg(NO_3)_2$ and isomorphous bismuth nitrates. In this elaborate procedure, he separated the rare earth mixture into light and heavy fractions. Bismuth nitrate was extremely useful here, as its solubility lay between those of samarium and europium. The bismuth could be removed with hydrogen sulfide, and then the remaining two fractions could be further separated and purified by employing double magnesium nitrate salts. By this method, Urbain was able to refute many of the spurious rare earth discoveries of others.[7]

Charles James, professor at the University of New Hampshire and member of ΑΧΣ's *Mu* Chapter,[8] is credited[4] with developing the best and most efficient overall scheme for separating the rare earths. In his complex flow chart, he used a large variety of rare earth salts, including oxalates, bromates, sulfates, ethylsulfates, and double nitrate salts of the rare earth and magnesium, ammonium, sodium, bismuth, and nickel—each specific step carefully chosen after trying out all possible systems. Even with his grand achievement, he admitted that it was not perfect, warning the reader that there is simply "no quantitative method of separation of any of the rare earths."[8]

Crookes, phosphorescence spectroscopy, and the meta-elements—anticipating the concept of isotopes? The complexity of the rare earths and confusion in their separation could engender unusual ideas. The classic example was the hypothesis of "meta-elements," spawned in the imaginative mind of William Crookes during his spectroscopic study of yttrium.

Crookes is perhaps best known for his invention of the "Crookes tube" in 1875, the original cathode ray tube which eventually led to the discovery of electrons in 1897 by Joseph John Thomson (1856–1940). Crookes also invented the radiometer, a popular scientific toy to this day. Another creation of his was the spinthariscope, which was popularized in the 1940s as the "Atomic Bomb Ring" displayed proudly by schoolboys who ordered them from breakfast cereal box advertisements.[1m]

Crookes split his activities between his home laboratory in east London (Figures 7–9) and the offices of *The Chemical News*. He founded and served as the editor of this "bumptious, gossipy"[9] journal in which he recounted the daily chemical discoveries (including his own, of course) and other happenings in the industrial world and the professional societies. His research was well respected, and he was elected a member of the Royal Society, of which he was president 1913–1915.

Another invention of Crookes was "phosphorescence spectroscopy," achieved by irradiating samples in his Crookes tube.[10] These spectra were more complex than the usual emission spectra, and he was able to detect variations with samples which otherwise showed identical spectra in ordinary emission spectroscopy.[7] He announced that "there were probably eight constituents into which yttrium might be split,"[11] and he reported similar behavior with samarium and gadolinium. Thus, he claimed, he had evidence for chemically identical elements which differed in their physical properties. He called these "meta-elements." And what would cause a difference in physical properties? Obviously, their atomic weights, he concluded.

This idea of meta-elements held appeal for some, particularly those in Great Britain, since the idea paralleled Prout's hypothesis (William Prout, 1785–1850) that all elements were built up of multiples of hydrogen.[7] Perhaps even a better candidate for the universal simple substance—called *protyle*[7]—might be helium, first spectroscopically observed in the sun in 1868,[1n] whose single spectral line (only one was known at that time) signaled its simple nature. By contrast, heavier elements, such as iron, exhibited a complex spectrum, consistent with a wide distribution of meta-elements.[7] Even some organic chemists weighed in with their endorsement; Jean-Baptist Andre Dumas (1800–1884)[ii] suggested that elements might be unusually stable radicals, just as an organic molecule is built up of smaller organic radicals.[7]

Crookes expanded his hypothesis to include genesis of the elements themselves: a cooling process of the *protyle*[7] in stars—he proposed the elements condensed into a statistical distribution of weights but with identical chemical properties. Thus, while the measured atomic mass of calcium was 40, actually there might be some 39, 38, and 41, 42—or perhaps 39.9, 39.8 and 40.1, 40.2, and so on.[12]

Figure 9. The chemical portion of Crookes' laboratory. Crookes applied his chemical and spectroscopic skills to the study of the rare earths. After radioactivity was discovered in 1896, he studied the radioactive elements.

Others had doubts as to the usefulness of the phosphorescence spectroscopy method. Boisbaudran[1b] stated that variations would likely to be simply due to impurities; and in fact he reported that in an ultra pure sample of yttrium, he could not observe a phosphorescence spectrum at all, but instead the usual emission spectrum.[7] Marignac[1o] argued that since there was no experiment to confirm the authenticity of meta-elements, the concept was useless.[7]

Clarification of the phosphorescence spectra phenomenon came two decades later. In 1919 Urbain completed a thorough study showing that trace amounts of impurities could drastically alter the phosphorescence spectra (anticipating the use of dopants in modern phosphors). Urbain could duplicate Crookes data by artificially prepared mixtures of the rare earths in the proper ratios.[13] Urbain also worked out procedures for the fractionation of double salts of the rare earths (RE/Mg) to prepare pure samples of the rare earths—and he extended Boisbaudran's work for yttrium to report that for all utterly pure samples of the rare earths, the anomalous phosphorescent spectra ceased to exist.[13]

Utterly unfazed by Urbain's criticisms, Crookes took advantage of his position as president of the Royal Society to announce in his 1914 President Address to the Royal Society[14] that he had anticipated Soddy's discovery of isotopes[1j] which had just been announced: "[Soddy's] 'isotopic' elements occupy the same place in the Periodic Table. He has thus arrived, by a totally different path from the one I travelled, at the conception of an element having atoms of different weight though chemically identical."

Although it is frequently mentioned that Crookes "was the first to suggest the existence of isotopes,"[9] it must be remembered that any similarity between Crookes' meta-elements (based on a false interpretation of spectral data) and Soddy's isotopes (securely founded on a wealth of radioactive and transmutation experimentation) is fortuitous—although great credit must be given to Crookes' spectral skill as well as his vivid imagination. At his Nobel address in 1921—"The Origin of the Conception of Isotopes,"[15] Soddy did not mention Crookes' work nor his meta-elements, but instead concentrated on the research on radioactive elements that provided the evidence for the concept of isotopes.[16]

The last of the natural rare earths. The last naturally occurring rare earth discovered was lutetium, in 1907. In *The HEXAGON* we have previously visited the convoluted story of this discovery.[1k] Today the discovery of lutetium is credited to three chemists: the opportunistic Urbain who published first (and prematurely), Welsbach who presented evidence that he had discovered the element earlier, and James who had the only pure sample of lutetium existing at that time. Today all three scientists are considered co-discoverers of lutetium.

At the time of the discovery of lutetium, Urbain was claiming evidence of another element beyond lutetium (atomic number 71), which he called "celtium."[1k] However, his preconceived notion that the next element would be a rare earth was leading him astray (the next element, atomic number 72, was actually hafnium[1k], which was not found in rare earth minerals but instead in zircon[1k]). Whereas Urbain was claiming he was obtaining purer and purer samples of "celtium" (which he followed by magnetic susceptibility measurements[10]), he was actually witnessing purer samples of lutetium, which others had already prepared.

Atomic numbers. By the turn of the century, the major question was: Just how many rare earths *did* exist? Even at this late stage, spurious rare earths were being reported; Crookes was announcing "ionium" and "incognitum" (1906) in his rare earth mixtures;[3f] Urbain was stubborn with his "celtium" (1907),[3e] and there was a smattering of other elements from Demarçay (1900; Σ, Γ, Δ, Ω, Θ), Brauner (1900; thorium-α and thorium-β), and Welsbach (1911; thulium I, II, III), as well as a few lesser-knowns.[3f]

Brauner, professor of chemistry at the University of Prague (today's Czech Republic), on the basis of the solubility trends of salts of the known rare earths, as well as the relatively large difference in the atomic masses of neodymium and samarium, in 1902 predicted an element between the two.[3b] Then in 1914 Henry Gwyn Jeffreys Moseley (1887–1915), with his X-ray studies, experimentally developed the concept of atomic numbers.[1i] Moseley showed that celtium was spurious and that a void lay between neodymium (element 60) and samarium (element 62), just as Brauner had predicted. One would surmise that this would quickly clarify the situation, because scientists would know where to look—in crude preparations of neodymium and samarium—but instead it led to more confusion and contention, and element 61 was not found until three decades later.

In the next issue of *The HEXAGON*, the search for element 61.

Acknowledgment.

The silent editor of these "Rediscovery" articles—Gerard R. Dobson, 1990 Kuebler Awardee, who has been invaluable for countless corrections and suggestions over the past 15 years—has in his possession, and on display in his home, one of the large crystallization dishes that Charles James used in his rare earth studies.

"REDISCOVERY" ARTICLES ARE NOW ON-LINE

All *HEXAGON* issues that include "Rediscovery" articles—a series which began in 2000—are now on-line at: *http://digital.library.unt.edu/explore/collections/HEXA/*

These *HEXAGON* issues, as a group, are fully searchable and thus are amenable to scholarly research. One can search either for words, Boolean "OR" combinations, or for full phrases (by placing in quotation marks). Not only the original "Rediscovery" articles may be accessed, but also cover photographs by the authors and other auxiliary articles connected with the "Rediscovery" project.

Additionally, the UNT Digital Library has separated out all these individual articles and placed them in the "Scholarly Works" section. These articles may be located and perused at: *http://digital.library.unt.edu.* At the top of the webpage, search for "James L. Marshall" as "creator" and for convenience, "sort" by "Date Created (Oldest)." The "Scholarly Works" articles are not searchable as a group, but only within each individual article.

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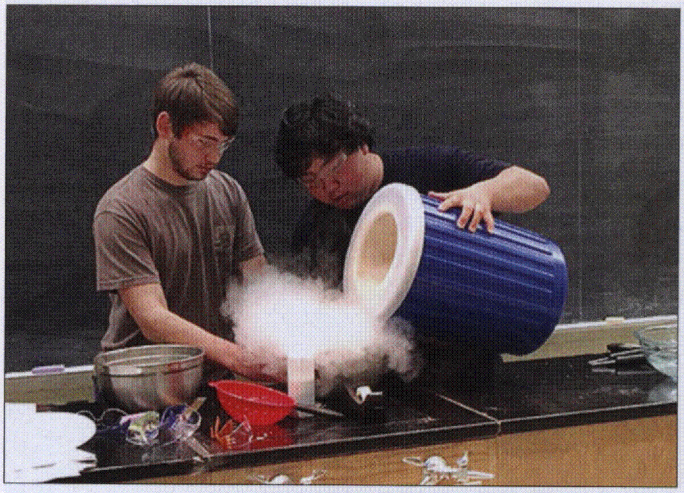


A careful pour during the liquid nitrogen demo.

Joshua Chamberlin, *Beta Chi 2014*, Chemistry Demonstrations for Level 4 Wyvern Pin

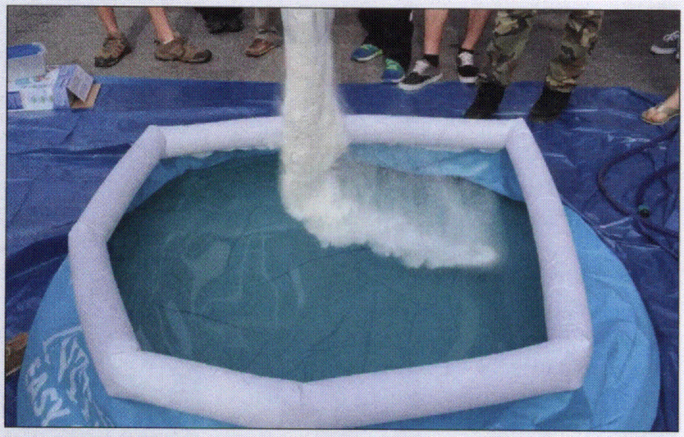
The Blue Wyvern Pin

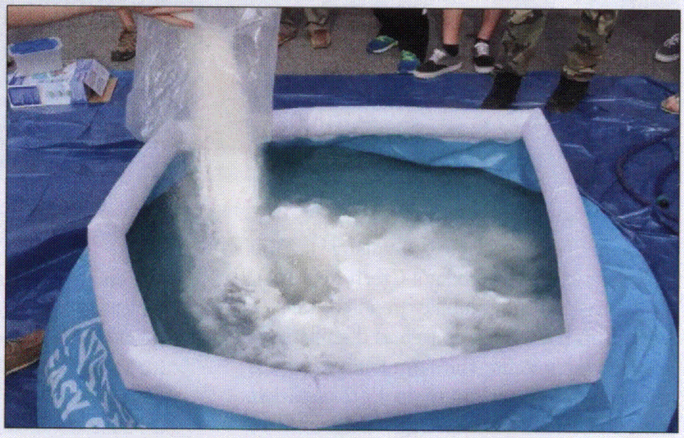
Joshua Chamberlin, *Beta Chi 2014*, completed 15 activities in a 36-month period. Joshua reports, "The activities I have completed have allowed me to be a better brother as well, allowing me to show my advancement of the Objects as my fraternal obligation. I have done many different activities ranging from demonstrations through chemistry club to participating in presentations for my research as a chemistry major at Hampden-Sydney College. My favorite events were those where I did demonstrations through the chemistry club with other brothers, faculty, and students of Hampden-Sydney College as my audience.

"The two demonstrations that the president of the chemistry club and I did were a liquid nitrogen demonstration and a polyacrylate absorption demonstration. For the liquid nitrogen demonstration, I prepped a few bowls of "dippin dot" ice cream the night before by making them with liquid nitrogen for people to actually enjoy while watching the demonstration. For the actual demonstration, we used approximately three liters of liquid nitrogen in a stainless steel bowl and took a condiment dispenser containing pre-made ice cream as a liquid and dropped it into the liquid nitrogen, which caused the ice cream to instantly freeze in the form of a dot. The audience was quite perplexed and enjoyed this demonstration.

"Toward the end of the demonstration, after we talked about how this exactly worked chemically, we allowed the kids of the faculty members to come up and attempt to make ice cream dots with our equipment.

"The second demonstration we did was also rather interesting because I had never seen it done on such a large scale. I ordered 10 pounds of polyacrylate from a company and filled a 120-gallon pool with water outside of Gilmer Hall. I scheduled an event and invited as many people as I could with posters and flyers detailing the event. In a lecture hall, before the demonstration, we explained the reaction that took place on a small scale with a 100-ml beaker of water and a small spoonful of polyacrylate. Then we took the audience outside and I demonstrated what would happen when 10 pounds of polyacrylate is dumped into 120 gallons of water. This demonstration had our audience in awe. I was a bit worried the polyacrylate would not be able to absorb the water in its entirety, but my previous calculations worked out and it was able to do so successfully."





10 lbs of polyacrylate absorbs 120 gallons of water.

Alpha Beta *Brothers Celia Tafatia, Andrew Banner, Courtney Asman, Caila Ryan and Alyssa Sebring with five of the Angell Elementary students at a Science Olympiad practice.*

Wyvern (level 4): Teaching Potions at Angell Elementary

Submitted by Courtney Asman, *Alpha Beta 2013*

The *Alpha Beta* Chapter of Alpha Chi Sigma undertook another semester of coaching for a Science Olympiad team at a local elementary school. Early 2015, starting in March, marked the third semester that the chapter has participated in the event and, as always, it was a favorite among the students and the brothers. I was nervous this year, because it was my first time taking one of the central roles in running the team. I know that I love science and I find chemistry fascinating, but it was daunting to face a group of eight- and nine-year-olds, hoping they were just as interested in learning as I was in teaching. For the Science Olympiad competition, the students are broken up into teams and required to complete two tasks. First, they must complete a test consisting of basic chemistry questions. Secondly, they must complete an experiment using the proper techniques and safety procedures. We were prepped with worksheets, demos, and lots of candy to encourage correct answers; the season had begun.

Right out of the gate, the kids were ecstatic. There was some minor disappointment when they found out that this "potions competition" wasn't quite like the potions classes in "Harry Potter," but that was set aside when they realized that chemistry experiments could be pretty magical, after all. They worked diligently on the worksheets, followed procedures for experiments, and loved interacting with the brothers, most of whom came every week to practices or at least came when they could.

As the season went on, the students became even more interested despite the topics getting harder. They asked intelligent questions, including a few that some of us could not answer off the tops of our heads. Eventually, after three months of practices, the teams were picked and prepped for competition. Speaking as the head coach, I felt more than confident they were ready and I know the other brothers, who had watched the team learn and grow, agreed.

I spent eight hours at their competition in May and after a nail biting awards ceremony, all of our teams received medals. To receive a medal, you have to be in the top six out of nearly 30 schools. Everyone at the *Alpha Beta* Chapter could not have been more proud, and a lot of the students were sad to see the season end. There were promises of competing again next year, wanting to study chemistry in the future, and maybe even wanting to come to the University of Michigan to join Alpha Chi Sigma. They have quite a few years between now and then, but the excitement we sparked in them for chemistry in just a few months makes me sure we will have a few more chemists in the future. All in all, it was an incredibly awarding event, and I know I, along with other brothers at *Alpha Beta*, am really looking forward to next season.

Middle school students work with carbon dioxide filled bubbles.

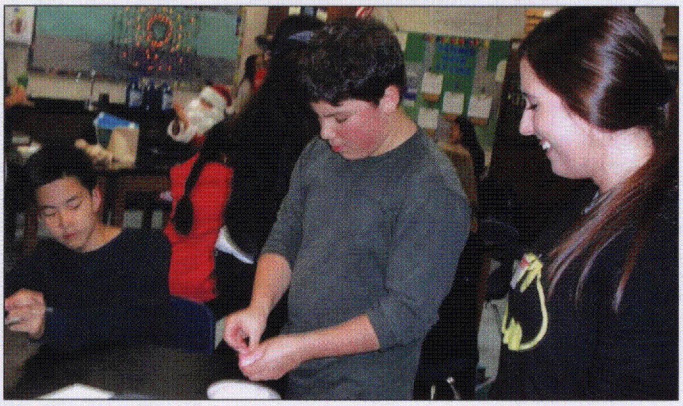
Wyvern (level 4): Clague School Halloween Demos

Submitted by Alexander Carley, *Alpha Beta 2013*

The *Alpha Beta* Chapter, at the University of Michigan, has established a working relationship with a teacher at Clague Middle School. Ms. Morningstar is an 8th grade science teacher who runs an afternoon "Homework Club." We have spent a lot of time and effort helping out with homework club, but we also wanted to explore new activities with the students, in particular, providing them with a fun and engaging way to enjoy chemistry and science.

As we were thinking about what to do, Halloween was quickly approaching. We put our heads together to come up with some exciting demonstrations that the students could experience. While having fun with carbon dioxide filled bubbles and making spooky colored glue slime, the students were exposed to concepts like sublimation and polymer reactions.

As a chapter that is very involved in the community, we find it important to target the youth of today and the future thinkers of our world. Promoting STEM topics and ideas is a passion we all share at *Alpha Beta*. We are truly glad to have established a relationship that we can really grow over the coming years.



Students prepare to slime.

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BEARDWOOD, Bruce A., *Chi 1956*
BIGELOW, Wilbur Brooks, *Alpha Theta 1979*
BROWN, Louis M., *Alpha Eta 1948*
BROWN, Stuart S., *Beta Delta 1949*
BUNNETT, Joseph F., *Rho 1953*
BUTTIGNOL, Valentino, *Gamma 1960*
CAMMACK, Jr., Hobart Z., *Alpha Chi 1947*
CAMPBELL, John A., *Nu 1958*
CARNES, William J., *Alpha Phi 1953*
GOODMAN, Ronald D., *Alpha Delta 1963*
GRIMM, James H., *Nu 1950*
HECK, Richard F., *Beta Gamma 1950*
HEISIG, Charles G., *Beta 1942*
HURD, Vincent N., *Nu 1939*
HYDE, Jr., Ernest B., *Kappa 1943*
KENDALL, H. Benne, *Gamma 1952*
MALCOLM, James E., *Alpha Rho 1941*
MATACEK, George F., *Zeta 1951*
NESS, Robert K., *Alpha Pi 1957*
OSTER, Robert A., *Zeta 1952*
PARKER, Collis R., *Alpha Eta 1947*
PAYNE, David A., *Zeta 1961*
REID, Edward J., *Pi 1948*
REISER, John S., *Alpha Omega 1944*
SCHNEIDER, Robert M., *Beta Zeta 1952*
SINGLER, Richard J., *Beta Tau 1967*
SPRUIELL, Joe E., *Alpha Phi 1955*
VAN HOUTEN, G. Robert, *Alpha Epsilon 1943*
WALDROP, Neal A., *Alpha Phi 1941*
WATTS, Richard W., *Nu 1941*
WILLIAMS, J. Larry, *Alpha Beta 1955*
WOODS, Everett M., *Alpha Beta 1944*
WRIGHT, Glen L., *Rho 1963*

Richard F. **HECK**, *Beta Gamma 1950*, who shared the 2010 Nobel Prize in Chemistry, died on Oct. 9 in Manila. He was 84.

His death was announced by De La Salle University in Manila, where he was an adjunct professor. He had moved to the Philippines with his wife, Socorro Nardo, who was Filipino, after retiring from the University of Delaware, where he did much of his research.

He conducted his Nobel Prize-winning work during the 1960s and early '70s, when he discovered what is now called the Heck Reaction. The reaction uses a palladium catalyst to create new carbon-carbon bonds.

The chemists who shared the Nobel with Dr. Heck were Akira Suzuki of Hokkaido University in Japan and Ei-ichi Negishi of Purdue University.

Richard Fred Heck was born on Aug. 15, 1931, in Springfield, Massachusetts. When he was a teenager, his parents moved to the suburbs of Los Angeles, settling in a house with a barren lot. While planting orchids there, Richard would often think about the chemicals in the fertilizer, a fascination that prompted him to study chemistry in school.

He completed his undergraduate degree at the University of California, Los Angeles, in 1952, and received a doctoral degree from that institution in 1954.

Like many organic chemists, Dr. Heck was on a quest to make important molecules more efficiently. Doing so involves identifying inexpensive, easily available starting materials and then performing experiments to convert the material into valuable products.

The Heck Reaction was one of the first metal-catalyzed reactions to use a small amount of expensive metal to form carbon-carbon bonds. It helped make strides in the field of organometallic chemistry, which combines organic and inorganic chemistry. It also helped revolutionize DNA sequencing by enabling the marking of DNA bases with organic dyes.

Dr. Heck and his wife settled in Manila after he retired from the university in 1989. She died in 2012. Since then, her family had cared for him while he underwent medical treatment.

A version of this article appears in print on October 16, 2015, on page B15 of the New York edition with the headline: Richard F. Heck Dies at 84; Shared a Chemistry Nobel, written by Nicholas St. Fleur; the edited version is used with permission, and remains copyright 2015 The New York Times Company.

Based on an article published in the Vicksburg Post *on October 15, 2015*

Funeral services for Noland J. **BOYD**, *Delta Beta 2013*, were held on Saturday, Oct. 17, 2015, at House of Peace Worship Church with the Rev. Robert Boyd officiating.

Dr. Boyd died Sunday, Oct. 11, 2015. He was 50 and an associate professor in the chemistry department at Alcorn State University. He was a member of Pleasant Green M. B. Church and a member of Alpha Chi Sigma, Beta Kappa Chi honor fraternity, and the American Chemical Society.

Survivors include his wife, Gwendolyn Lampkin Boyd; son, Jonathan Boyd; daughter Nanette Boyd; his mother, Daisy White Boyd of Vicksburg; and cousins and other relatives.

Based on an article published in the Toledo Blade *on October 18, 2015*

Ronald David **GOODMAN**, *Alpha Delta 1963*, passed away after a long battle with Parkinson's disease on Friday, Oct. 16, 2015.

He is survived by his wife, Sue Muller; daughters, Lisa and Julie Goodman; granddaughters, Lily and Zoe Simon; son-in-law, David Simon; former wife, Susan Goodman, and his dear hospice family of Hospice of Northwest Ohio.

His family will remember him for his brilliance, profound curiosity, and seemingly endless list of talents. He dabbled in art and photography, played the violin, penned satire and recorded comedy sketches mocking local politics. He loved making people laugh.

A longtime chemical engineer for LOF/Pilkington, he was named in 19 different patents for his work on glass design. He also earned a law degree from University of Toledo, and briefly practiced law. He was a member of the Scott High School Class of 1962 and the University of Cincinnati Class of 1967.

Choppin, Alpha Chi Sigma Hall of Fame Inductee 2010 passes

Based on an article published in Tallahassee Democrat *from Oct. 24 to Oct. 26, 2015*

Gregory Robert **CHOPPIN**, *Beta Iota 1973*, born in 1927, passed away Oct. 21, 2015, surrounded by his family. Greg is survived by his wife of 64 years, Ann Warner Choppin; his children, Denise Choppin (Paul McCall), Suzanne Choppin (Michael Brezin), Paul Choppin (Brenda) and Nadine Choppin (Bill Wagner); and by his grandchildren, Marc and Keith McCall and Mia, Rhemy and Madeline Brezin. Greg was a loving and supportive husband, father and grandfather who inspired his family with his strong ethical perspective, love of learning, sharp wit and zest for life. Greg is also survived by his brothers, Gerald and Gilbert Choppin.

Greg grew up in New Orleans. He attended Aloysius High School and received a B.S., maxima cum laude, from Loyola University. Greg's undergraduate studies were interrupted by service in the Army during the occupation of Japan. After his military service, Greg earned a Ph.D. in cChemistry from the University of Texas. He completed post-doctoral studies and was employed as a research scientist at the Lawrence Radiation Laboratory, University of California-Berkeley, under Dr. Glenn Seaborg, where he was a co-discoverer of chemical element 101, Mendelevium. In 1956, Greg joined the chemistry faculty at Florida State University, where his research focused on the rare earth elements and radioactive heaviest elements, resulting in the publication of 13 books and more than 300 research papers. As a teacher and researcher, Greg fostered the careers of innumerable students and formed close enduring relationships with his loyal band of "Choppinites." His love of teaching was recognized in 1967 by his designation as a R.O. Lawton Distinguished Professor and receipt of the Manufacturing Chemists Association National College Chemistry Teacher Award in 1979. Greg loved teaching and research so much that he continued to work despite being feted at several retirement parties over the years.

Greg enjoyed a rich fulfilling life personally and professionally. His wide-ranging interests included sailing, scuba diving, history, art, literature, astronomy, photography, bonsai and collecting Uranium glass. His professional accomplishments and endeavors allowed Greg and Ann to indulge their love of travel, maintaining close relationships with friends and colleagues all over the world. When not traveling, Greg and Ann enjoyed the serenity of their lakeside home and the beach at St. George Island.

In the course of his long career, Greg's achievements were recognized through numerous awards and honors, including honorary doctorates from Loyola University and Chalmers University in Sweden, the Humboldt-Stiftung U.S. Senior Scientist Award (1979), the American Chemical Society Award for Nuclear Chemistry (1985), the Seaborg Award in Actinide Separation Science (1989), the Spedding International Award in Rare Earth Science (1996) and the Becquerel Medal for Nuclear Chemistry of the British Royal Chemical Society (2000). The Chemistry Wing of the Science Building at Loyola University bears his name, the "G.R. Choppin Wing," and FSU created the Gregory Robert Choppin Chair in Chemistry and Biochemistry in his honor. Both were endowed by his lifelong friend Tom Benson.

Based on an article in The News Journal *from Oct. 21 to Oct. 23, 2015*

Dr. Wilbur Brooks **BIGELOW**, *Alpha Theta 1979*, age 73, passed away peacefully on Oct. 16, 2015 in Indiana, where he had lived and taught for many years. He is survived by his sister, Barbara Sheridan, and her husband, John Sheridan, and their two sons. He was proud of his nephews, Daniel Sheridan (Katie Messner) and Timothy Sheridan and great-niece Emsley Sheridan.

Brooks graduated from Mount Pleasant High School, completed a bachelor's degree at the University of Delaware, and earned his Ph.D. in chemistry from New Mexico State University. He became a member of the Alpha Chi Sigma professional fraternity. He taught chemistry in Arkansas, Florida, Iowa and western Indiana. Brooks settled in as an associate professor at Trine University in Angola, Indiana, where he taught freshman, organic, inorganic, instrumental, and physical chemistry for 28 years. He was a member of the American Chemical Society for 50 years and treasurer of the local chapter in later years. When he was not teaching chemistry, Brooks enjoyed working with model train cars and engines at the Garrett Model Railroad Club in Garrett, Indiana, where he was also treasurer. He also loved fly fishing at Lake Mansfield in Vermont, where he went for vacation every year. Each year Brooks returned to Delaware to spend two weeks at Christmas and a few days in the summer with his family. He will be missed by his family, train club members, Trine University colleagues, and wonderful neighbors in Angola. ○

Lisa (Douglass) **TORRES**, *Alpha Beta 1972*– I retired in June after 39 years teaching high school chemistry. I am still teaching a summer course in Field Ecology in the Enfield Shaker Museum in New Hampshire, and am planning a trip next year to Ghana, where I served in the Peace Corps after graduating from college.

Richard E. **SENTMAN**, *Alpha Theta 1972*– is retired from City of Cedar Rapids Water Pollution Control Facilities and Municipal Water Department. Retirement started January 1, 2011. I started in WDC September 17, 1973.

L. Bradley **STANFORD**, *Upsilon 1959*– retired from the Office of Naval Research after 32 years in Planning, Assessment, and Budgeting for basic science support.

A Note for Contributors

We certainly appreciate the added appeal of pictures in *The HEXAGON*. When taking photos for submission, please:

- Always use a flash indoors.
- Do not edit or alter your images. *The HEXAGON* production staff can and will determine if an image needs color correcting or additional processing.
- Set your digital camera quality to its highest setting with the least compression. Photos that are less than 8 inches wide at 72 dpi, or that have a file size of under 1 megabyte, may be too small for print production.
- Please send us the image file that is directly from the camera. Photos that are extracted from iPhoto albums, Facebook pages or Word documents have file sizes that have been compromised.
- Print photos are welcome!

NEW INITIATES

GAMMA IOTA
Alyse M. Hopkins
Melissa J. Rizor
Hayley N. Widden

GAMMA NU
Jacob D. Dickman
Kimberly Dominguez
Brooklynn Gonzalez
Joselyn S. Hines
Megan McClain
Nicole M. Meyer
Devin M. Ordich
Harley R. Pairan
Andrew J. Petry
Lindsie D. Shaffer
Madelon V. Stack
Roxanne Stalder
Marissa van Rhijn
Brittney Williams

ALBION COLLEGE COLONY OF ALPHA BETA
Christopher P. Armstrong
Hanna M. Atkinson
Christine A. Gauss
Courtney A. Kondor
Kenton J. McCosh
Shannon E. Murphy
Alexandra R. Rola
Megan R. Sheridan
Andrew C. Strzelecki
Jeanne B. Morin-Leisk
Clara A. Posner
Alexander M. Spokoyny
Panisa Cream Sundravorakul
Yi Yang
Maya Yu

D. Mitch Levings, OA, Grand Historian
Beta Delta 1975

100 years ago…Winter 1915/16

Trouble was brewing in Columbus, Ohio, where the activities of Ohio State's *Lambda* Chapter caught the attention of the Supreme Council. Details of precisely what was going on are somewhat sketchy, but GMA Harry Curtis was concerned enough to submit SC Proposition 106, "Shall we withdraw our charter from *Lambda* Chapter for persistent violations of the laws of the Fraternity? I have already written you the facts of the case and recommend that this action be taken." A few weeks later, Grand Recorder-Treasurer Leon Shaw sent a post card to the Supreme Council stating, "Kindly disregard and destroy the record of vote on Proposition 106. Fraternally yours, Grand Recorder-Treasurer." Whatever was going on at *Lambda* continued to concern the Supreme Council and they were, for the first time, faced with how to execute the steps necessary to actually revoke a charter. The SC debated whether to give the Grand Chapter a vote or revoke the charter by SC decree, and just inform the chapters of their decision. The SC reached unanimous consensus that the chapters should get a vote on charter revocation. The SC was also clear that they did not want to wait until the upcoming conclave to take action. The GMA was authorized to dispatch a member of the Fraternity to Columbus to study the situation and report back on the advisability of revoking *Lambda's* charter. The details of that investigation are unknown, but *Lambda* did not lose their charter. Since there was no mention of problems at *Lambda* in *The HEXAGON* and Harry Curtis chose not to include the incident in his comprehensive history of the Fraternity's first 25 years, the matter must have been satisfactorily resolved.

The Supreme Council voted to approve a charter for the Golden Gate Alumni Chapter, but refused to grant *Gamma* Chapter's request to initiate first semester sophomores.

The HEXAGON marked the 13th birthday of the Fraternity by making the analogy of a child becoming a youth, who at 13 is apt to feel a great deal more adult than he really is.

75 years ago…Winter 1940/41

The San Francisco Professional Chapter reports that their October meeting was held on November 25 (I just report 'em as I read 'em.—GH). The guest speaker for the evening was from the Better Business Bureau warning of the many frauds being perpetrated on the American public. The New Orleans Professional Chapter met at the Dixie Brewing Company.

The January 1941 edition of *The HEXAGON* contained a plea for Metallurgists and Metallurgical Engineers needed for National Defense work. The salaries ranged from $3,200 to $5,600 a year.

A committee consisting of Paul Wenaas, Eugene Dufy, and Louis Eilers issued the Revised Professional Branch Program. The program was a set of guidelines identifying six areas where the Professional Branch would concentrate their efforts: Service to Chemistry and Chemists; Recognition of Achievements; Service to Collegiate Chapters; Strengthening Professional Chapters; Increasing Contacts between Professional Branch members; and Establishment of New Professional Chapters.

50 years ago…Winter 1965/66

On January 8, the Supreme Council met at the Sheraton O'Hare Inn in Des Plaines, Illinois, to conduct some of the more mundane business of the Fraternity. The main reason for meeting, however, was to conduct a formal interview with Stephen Cobb for the position of full-time Grand Recorder. Brother Cobb was later flown to Indianapolis to interview with interim GR Merle Griffin and get a more complete picture of the National Office operations.

Tau Chapter reports a membership of 40, with 22 living in the house. They also proudly announce that of the 52 fraternities on the Cornell campus, Alpha Chi Sigma ranks first in academics.

Serf Guerra resigned as Mid-Atlantic District Counselor. To replace him, the Supreme Council appointed Dave Rothel.

In lieu of a regular business meeting, the December get-together of the Kansas City Professional Chapter was a two-home progressive dinner. Keith Birkett and his wife hosted the first courses, while the final courses were served at the home of Don Coyne. This was a couples event attended by 10 KC Pro couples, eight *Kappa* Chapter men with their dates and *Beta Rho* advisor Robert Kiser with his wife.

The Los Angeles Professional Chapter invited stockbroker Lewis Habash to be the speaker at their February meeting. Mr. Habash shared his insight into current market conditions and discussed the importance of timing when making stock sales or purchases.

25 years ago…Winter 1990/91

At 10:02 a.m. on December 2, 1990, the enter key was pressed and the Alpha Chi Sigma Electronic Bulletin Board went live. Accessible through the Fraternity's 800 number, the BBS was on-line between 5 p.m. and 8 a.m. Monday through Friday and 24 hours on Saturdays and Sundays. This new technology gave Fraternity members the ability to communicate through numerous forums and leave messages for the Supreme Council. Members could upload and download files and forms and greatly reduce the amount of time it took to exchange information. The downside of the BBS was that with only one phone line, callers could not leave messages on the National Office's answering machine whenever the BBS was active.

On January 19, 1991, *Beta Eta* Chapter at the University of North Texas held their regular initiation. In addition to the North Texas pledges, there were eight members of the UT Alchemists, a chemistry club at the University of Texas. By special permission of the Supreme Council, these eight members would be recorded as members of *Beta Theta*, the inactive chapter at UT-Austin. This marked the first *Beta Theta* initiates in more than eight years and set the stage for the reactivation of the chapter.

Expansion activity was also present at James Madison University. ECDC Mark Evaniak was in communication with local chemistry fraternity Kappa Sigma Mu, helping them to create a petition to affiliate with Alpha Chi Sigma. In early February, Pamela Martin, president of Kappa Sigma Mu, mailed the completed petition to Indianapolis.

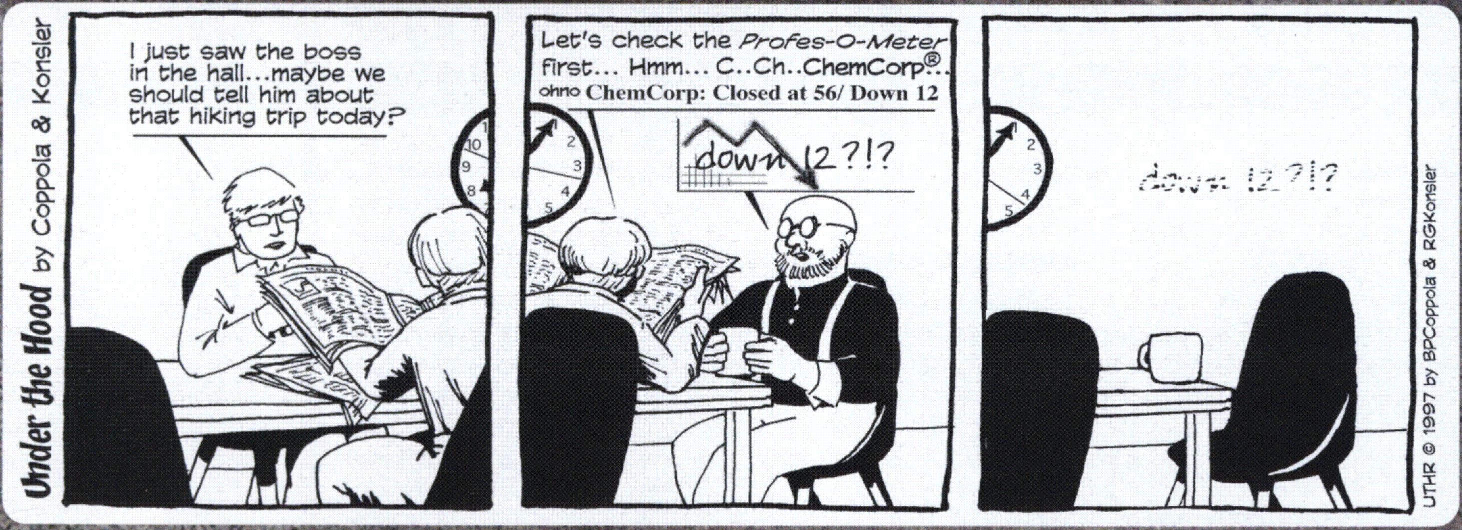
Epsilon Chapter (Indiana) moved into their new chapter room, CH 044, directly across from the freshman labs. After much debate and discussion, the chapter also switched from a fall and spring pledge class to a single, larger pledge class with one initiation during the winter.

10 years ago…Winter 2005/06

The Supreme Council met at the National Office on January 6–8. In addition to the Council, the meeting was attended by Grand Recorder Emeritus Paul Jones, Grand Vizier John Adams, NCDC Jen Showerman, Harold Cowan, Christy Gesell, Pat Kemle and Jane Pepper. Budget and Conclave planning were the major topics of discussion. Professional Representative election results were reviewed and ratified. Receiving the most votes were Helen Webster, Jeff More, Abbey DeGraffenreid, Bill Courtney and Pete Ritter.

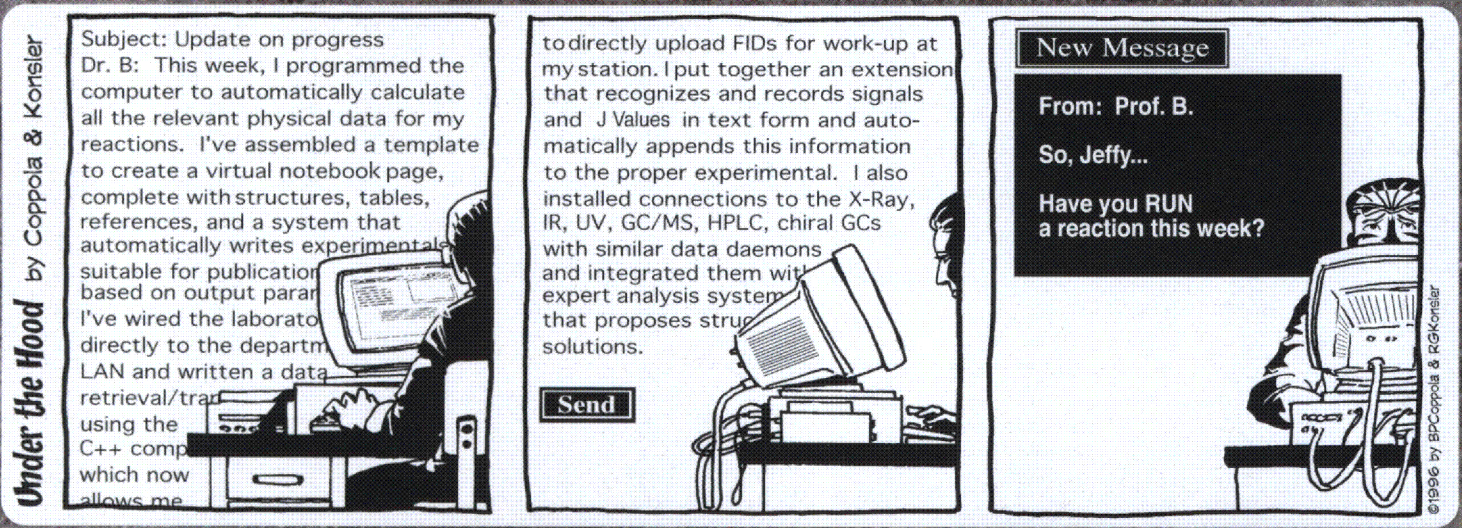
The reactivation effort for *Beta Psi* Chapter at Southern Illinois University-Carbondale reached fruition. The authority for *Zeta* Chapter to pledge and initiate SIU-Carbondale students was extended by the Supreme Council, giving the Carbondale group time to prepare a petition for reactivation. On February 2, Supreme Council proposition 4095 declared *Beta Psi* reactivated, effective February 3, 2006. April 29 was selected for an official reactivation ceremony.

HOT RETORTS



Under the Hood by Coppola & Konsler
I just saw the boss in the hall...maybe we should tell him about that hiking trip today?
Let's check the Profes-O-Meter first... Hmm... C..Ch..ChemCorp®...
ohno ChemCorp: Closed at 56/ Down 12
down 12?!?
down 12?!?
UTHR © 1997 by BPCoppola & RGKonsler

Under the Hood by Coppola & Daniels
"Here...try two Erlenmeyers..."
C-C-CR-RASH!
TINK - TINK - TINK - TINK
"Not enough...try three more beakers and another flask..."
K-K-KEEERRRUNNCHH!
TINKLE TINKLE TINKLE TINKLE
"Not quite...try one less beaker and add a graduated cylinder..."
CRRRASSHH
What is going on in here?!?
The tech dropped a tray of glassware this morning and shattered everything! We're trying to figure out what was on the tray...



Under the Hood by Coppola & Konsler
Subject: Update on progress
Dr. B: This week, I programmed the computer to automatically calculate all the relevant physical data for my reactions. I've assembled a template to create a virtual notebook page, complete with structures, tables, references, and a system that automatically writes experimenta suitable for publication based on output para I've wired the laborato directly to the departm LAN and written a data retrieval/tra using the C++ comp which now allows me
to directly upload FIDs for work-up at my station. I put together an extension that recognizes and records signals and J Values in text form and automatically appends this information to the proper experimental. I also installed connections to the X-Ray, IR, UV, GC/MS, HPLC, chiral GCs with similar data daemons and integrated them wit expert analysis system that proposes stru solutions.
Send
New Message
From: Prof. B.
So, Jeffy...
Have you RUN a reaction this week?
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BETA*-University of Minnesota Minneapolis, MN
GAMMA-Case Western Reserve University Cleveland, OH
DELTA-University of Missouri Columbia, MO
EPSILON-Indiana University Bloomington, IN
ZETA-University of Illinois Urbana, IL
IOTA-Rose-Hulman Institute of Technology Terre Haute, IN
MU-University of New Hampshire Durham, NH
PI-Syracuse University Syracuse, NY
RHO-University of North Carolina Chapel Hill, NC
SIGMA*-University of California-Berkeley Berkeley, CA
TAU*-Cornell University Ithaca, NY
ALPHA ALPHA-Stanford University Stanford, CA
ALPHA BETA*-University of Michigan Ann Arbor, MI
ALPHA EPSILON-Washington University Saint Louis, MO
ALPHA THETA*-University of Iowa Iowa City, IA
ALPHA KAPPA*-University of Virginia Charlottesville, VA
ALPHA PI-George Washington University Washington, DC
ALPHA RHO-University of Maryland College Park, MD
ALPHA SIGMA-University of Arkansas Fayetteville, AR
ALPHA UPSILON-Michigan State Univ. East Lansing, MI
ALPHA OMEGA-Georgia Institute of Tech Atlanta, GA
BETA GAMMA-Univ. of California-LA Los Angeles, CA
BETA DELTA-Missouri University of Science & Technology Rolla, MO
BETA IOTA-University of Florida Gainesville, FL
BETA ETA-University of North Texas Denton, TX
BETA MU-Occidental College Los Angeles, CA
BETA NU*-Purdue University West Lafayette, IN
BETA PI-University of the Pacific Stockton, CA
BETA RHO-Kansas State University Manhattan, KS
BETA SIGMA-Rochester Institute of Tech. Rochester, NY
BETA TAU-University of Arizona Tucson, AZ
BETA PHI-South Dakota School of Mines & Tech Rapid City, SD
BETA CHI*-Hampden-Sydney College Hampden-Sydney, VA
BETA PSI-Southern Illinois University Carbondale, IL
GAMMA BETA-Florida State University Tallahassee, FL
GAMMA DELTA-The College of Charleston Charleston, SC
GAMMA ZETA-California Polytechnic State University San Luis Obispo, CA
GAMMA ETA-Marshall University Huntington, WV
GAMMA THETA-Truman State University Kirksville, MO
GAMMA IOTA-Virginia Polytechnic Blacksburg, VA
GAMMA KAPPA-James Madison Univ. Harrisonburg, VA
GAMMA NU-Ohio University Athens, OH
GAMMA XI-North Carolina State Univ. Raleigh, NC
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GAMMA TAU-Indiana University of Pennsylvania Indiana, PA
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GAMMA PSI-University of Toledo Toledo, OH
GAMMA OMEGA-Widener University Chester, PA
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DELTA GAMMA-Georgia Southern University Statesboro, GA
DELTA DELTA-Southeast Missouri State University Cape Girardeau, MO
DELTA EPSILON-Boston University Boston, MA

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COLONY OF GAMMA DELTA-University of Tampa Tampa, FL
COLONY OF DELTA BETA-University of New Orleans New Orleans, LA
PHILADELPHIA U COLONY OF GAMMA OMEGA-Philadelphia University Philadelphia, PA
WINTHROP U COLONY OF RHO-Winthrop University Rock Hill, SC
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