Proceedings of the Indiana Academy of Science
(1995) Volume 104 p. 67-80

EARLY HISTORY AND DEVELOPMENT OF CHEMISTRY AT OLDER INDIANA COLLEGES AND UNIVERSITIES

Harry G. Day
Department of Chemistry
Indiana University
Bloomington, Indiana 47405

ABSTRACT: The development of chemistry at most of the older baccalaureate degree granting institutions in Indiana is concisely surveyed. These Indiana institutions are compared with other schools in America, that are also accredited by the American Chemical Society for professional training in chemistry. At each institution, special attention is given to the honors received by their chemistry faculty, their current number of graduating chemistry majors, and the achievements of their most notable chemistry alumni. The influence of Indiana's emergence as a State is related to its provision for the education of its residents. The roles of cultural idealism and religion on the development of higher education in Indiana are also discussed. In general, published histories of the chemistry programs (as well as for other scientific disciplines) are lacking for many Indiana institutions. The beneficial influence of the Indiana Academy of Science on the development of the sciences is underscored.

KEYWORDS: Accreditation for professional training in chemistry, idealism and education, brief sketches of fifteen older institutions, prestigious individual accomplishments and recognitions, recent data on chemistry degrees granted in Indiana.

INTRODUCTION

One chapter in my book, *Development of Chemistry at Indiana University 1829-1991,* dealt with the history of chemistry at the academic institutions in Indiana, where it is a significant component of the curriculum (Day, 1992). With the help of one or more knowledgeable persons connected with each school, meaningful facts and well based impressions were obtained and carefully considered in preparing that chapter. Their assistance is much appreciated.

These institutions may be compared with other schools in America, which are accredited by the American Chemical Society (ACS) for professional training in chemistry at the baccalaureate level (Ross, 1993). In 1991-92, Indiana University at Bloomington (IU) ranked sixth in the nation in the number of chemistry graduates (37), and Purdue was twenty-third (23). For doctoral graduates, Purdue ranked third (55), but IU did not rank in the top twenty-five (19). Of the State's private institutions, the top four based on the number of certified graduates were Notre Dame (7), Butler (6), Wabash (6), and Valparaiso (4). The number of graduates at other Hoosier institutions was lower.

In 1991-92, IU had a total of 135 bachelors-level graduates (37 certified and 98 uncertified). The University of Illinois, being second, had a total of 116 graduates (46 certified and 70 uncertified), and the University of California at Los Angeles (UCLA), being third, had a total of 109 graduates (6 certified and 103 uncertified). No other school in Indiana ranked in the top twenty-five. IU has held its position for several years, although the number of graduates did drop slightly in 1992-93.

Table 1. Chemistry degrees awarded in 1991-92 and 1992-93 by Indiana schools offering an ACS-accredited program for professional training in chemistry (Ross, 1993, 1994).

	Bachelors				MS		PhD	
	Certified		Non-Certified					
UNIVERSITY	1992	1993	1992	1993	1992	1993	1992	1993
Ball State	15	15	9	7	2	8	—	—
Butler	6	5	8	13	0	3	—	—
DePauw	1	0	12	9	—	—	—	—
Earlham	0	0	3	11	—	—	—	—
Evansville	2	4	5	5	—	—	—	—
Indiana State	6	7	0	1	0	1	0	—
Indiana-Purdue								
Fort Wayne	5	5	0	4	0	0	—	—
Indianapolis	5	6	14	14	9	0	1	1
Indiana								
Bloomington	37	32	98	117	11	10	19	29
Northwest	1	2	0	1	—	—	—	—
South Bend	8	3	0	0	—	—	—	—
Southeast		2		9		—	—	—
Notre Dame	7	7	13	13	8	4	8	9
Purdue								
Lafayette	23	18	21	25	11	11	55	43
Calumet	0	5	3	2		—	—	—
Rose-Hulman[1]	4	6	0	0	—	—	—	—
Valparaiso	4	5	16	20	—	—	—	—
Wabash[2]	6	4	9	5	—	—	—	—
Total 18	148	131	211	256	41	46	83	82

[1] Institute of Technology
[2] College

In the most recent analysis (Ross, 1994), no striking changes occurred in the overall number of bachelors degrees in chemistry awarded by the 18 campuses whose undergraduate chemistry programs were certified by the ACS (Table 1). However, in 1992, the total number of bachelors degrees awarded to students completing the ACS program was 148 as compared with 131 in 1993. The number of students getting bachelors degrees without completing this program rose from 211 in 1992 to 256 in 1993.

In the nationwide ranking for 1992-93 (Ross, 1994), IU placed second based on the number of bachelors degrees granted (149), while UCLA was first (152). North Carolina State University was third (110), and the University of Illinois was fourth (103).

For doctoral graduates nationwide in 1992-93, Purdue University ranked fourth (43), and IU was seventeenth (29). Within the Big Ten, the order of ranking for doctoral graduates in 1992-93 was: Purdue (43); Minnesota (39); Wisconsin (37); Northwestern (36); Ohio State (33); Indiana (29); Penn State (28); Illinois (26); Michigan State (26); Iowa (23); and Michigan (20).

EARLY CONTRIBUTIONS THROUGH THE INDIANA ACADEMY OF SCIENCE AND OTHERS

Included in the historically valuable sources of information on the development of chemistry in Indiana are the published reports from the December 1916 observance of *A Century of Science in Indiana,* a symposium which was a major part of the Thirty-Second Annual Meeting of the Indiana Academy of Science (Bigney, 1916). Further information on the development of chemistry was presented in a second symposium, *There Were Giants in Those Days,* at the Academy's Annual Meeting in 1985, when the centennial of the IAS was observed (Day, 1986).

William and Fay Daily's (1984) fact-filled chronicle of the Academy's first 100 years is also an important source of information on the history of chemistry in Indiana. As the chairman of the Academy's Centennial Committee, John B. Patton wrote in the preface of the Dailys' history: "This they have done with a degree of dedication....that places Academy members of the past, the present, and the future permanently in their debt".

Two of the most influential charter members of the Academy became outstanding national leaders in chemistry and remained participating Academy members throughout their lives, even though their major professional contributions occurred after they had moved from Indiana (Daily and Daily, 1984). They were H.W. Wiley (1844-1930) and W.A. Noyes, Sr. (1857-1941). At least four other Academy members should also be mentioned: John N. Hurty (1852-1925), who was a major influence in forming public health policy, especially in Indiana; Henry A. Huston (1858-1957), a Purdue professor of agricultural chemistry from 1888 to 1903 and recipient of an honorary Sc.D. degree in 1931; Richard Owen (1810-1890), an Indiana University professor of natural science (primarily chemistry, physics, and geology) from 1864 to 1879 and the second State Geologist; and Robert B. Warder (1848-1905), an Earlham graduate and Purdue professor of chemistry from 1883 to 1887, following which he was at Harvard until his death.

Based on a study of Indiana scientists through the first half of the twentieth century, S.S. Visher (1951, p. 209) concluded that Hoosier chemists comprised slightly more than one fourth of the scientists sketched in one or more of the eight editions of *American Men of Science, 1906-49.* This distribution has not changed significantly during the second half of this century.

Visher (1951, p. 266) paid particular attention to Indiana scientists who had been starred in any of these issues of *American Men of Science.* Starred scientists were elected "by secret ballot of the leaders in their sciences, as especially distinguished in research." Regarding the past and present chemistry faculty at Indiana colleges and universities, Visher stated (1951, p. 210) that "the following have been starred in chemistry: *DePauw,* [S.A.] Lattimore; *Earlham,* H.N. Holmes; *Indiana University,* F.T. Gucker, R.L. Shriner; *Notre Dame,* J.A. Nieuwland; *Purdue,* H.B. Hass, Walter Jones, H.W. Wiley; *Rose,* W.A. Noyes, Sr.; and *Wabash,* Alexander Smith." All these institutions had been established well before the end of the nineteenth century.

Visher also noted (1951, p. 209) that up to 1949, "Thirteen chemists who have been starred obtained their college training in Indiana." He pointed out that up to that time no chemistry graduate of Indiana University had ever been starred.

Concerning Purdue, he wrote that since 1892, no Purdue alumnus had received such recognition. In the second half of the twentieth century, several chemistry graduates from both of these universities had achievements which equaled or exceeded the earlier starring standards of *American Men of Science.* Regarding the colleges and universities with starred chemistry alumni prior to 1949, Visher recorded (1951, pp. 209-210) the following: "*Butler,* Cope; *DePauw,* Bacon, Clark, Fenske, Lattimore; *Earlham,* H.E. Howe, Stanley, R.B. Warder; *Hanover,* Wiley; *Manchester,* P.J. Flory; *Notre Dame,* J.A. Nieuwland; *Purdue,* McCoy; and *Valparaiso,* J.E. Temple."

In addition, Visher recorded (1951, p. 209) the Indiana-born chemists, who had been starred before 1949: "R.F. Bacon, G.L. Clark, A.C. Cope, M.R. Fenske, C.A. Kraus, S.A. Lattimore, H.M. McCoy, W.A. Noyes, Jr., Lee J. Smith, W.M. Stanley, and H.W. Wiley." He added that H.C. Urey, who was not starred, was born in Indiana, and, like Stanley, had become a Nobel Laureate.

BACKGROUND FOR UNDERSTANDING

An understanding of the development of chemical education can only be obtained by placing the discipline squarely in the Indiana of the nineteenth century. An important source is Logan Esarey's (1915) volume on Indiana history up to 1850. As he made clear, Indiana was largely wilderness, and the sparse and scattered population included a few Indian tribes. By 1816, the quest for statehood had been initiated, and a State Government had been formed.

Esarey (1915, p. 289) wrote:

> "The Constitution directed the General Assembly to provide for a complete system of schools ascending in regular graduation from township schools to a State University. This ambitious program was destined to remain a dead letter for almost a century. There was no system [for implementation] and very few schools in Indiana before the Civil War."

Without an adequate program of public and private general education, higher education could not develop satisfactorily.

After pointing out the lamentable faults in public education, at least until "the revision of the school laws of 1843," Esarey (1915, p. 209) further wrote (1915, p. 291): "Despairing of any relief from the public schools, the churches each in its way, tried to solve the problem of public education." Many of the preachers and priests taught in "private subscription schools." Also, Esarey referred to itinerant teaching in non-public schools. Although the elementary schools, both public and private, were fundamentally important for every citizen, Esarey (1915, p. 291) had to conclude that: "Higher education fared better in early Indiana than did the common schools." In the chapter on "Religion and Education in Indiana," he (Esarey, 1915, p. 292) stated that: "The intense religious feeling of the times interfered with any united effort in higher education." Additional deterrents to developing a well integrated school system were government ineptitude and a philosophical reluctance to tax the people for the support of education. Esarey concluded that this situation did not significantly change until about 1867.

Other factors also stimulated education. For example, Esarey (1915, p. 248-249) pointed out: "Beside the ordinary American pioneers who flocked to Indiana there were a few representatives of the peculiar religious and economic ideas then prevalent in the East." One of these was the Harmonie group (Rappites), who, in 1814, moved from Pennsylvania to the area that now includes New Harmony. Within about one decade, their program floundered and was succeeded by Robert Owen and his idealistic followers. Included in Owen's group were a substantial number of adventurers without noble aspirations. The "Owenites" also included intellectuals with differing cultural compulsions. As an organized effort, the community lasted only a short time (from 1825 to 1827), but some of the proponents of such intellectualism remained in Indiana and were influential in the development of both private and public higher education.

The first full-length scholarly history of New Harmony and Robert Owen's "idealists" was written by William E. Wilson (1964), who grew up in that community. As a noted professor and writer at Indiana University during the middle of the twentieth century, Wilson masterfully created a perceptive word picture "of this amazing community." Regarding the especially relevant aspects of the Rappites and the Owenites, on the jacket of Wilson's book (1964), it is written: "Both societies also left their mark on New Harmony where sturdy homes and buildings erected by the founders bear testimony to careful planning. The first public school system open to boys and girls alike, the first free public kindergarten and trade school, and a unique Workingmen's Institute and Library originated here." No specific cathedral of learning arose in New Harmony from the visions and efforts that centered for a time in the area. But the educational influence became a positive factor throughout the developing State, including the State Government. In particular, among the dozen or so more strongly influential Owenites were three of Robert Owen's sons (Richard, Robert Dale, and David Dale) as well as William Maclure.

As picturesquely summarized by Wilson, the disintegration of the Rappite social system and then the Owenite system left an afterglow "from 1830 on to the end of the century." He further stated (Wilson, 1964, pp. 190-191) that it:

> .....is to visualize Owenism on the Wabash as the explosion of a rocket and the varied subsequent activities of Owen's descendants and other New Harmonites as the shower of sparks that follows a rocket bursting. None of the sparks was of the brightness or magnitude of the original flash, and in their scattering there was no central brilliance upon which the historian's eye can focus, such as the "Community" of Owen's and Maclure's time. Each went its own way, eccentric and alone; and yet, together, they created an "afterglow" above the town's life that kept it unique in the Middle West, and indeed in the nation, for a long time.

Wilson (1964, p. 188) also emphasized this notable fact: "Maclure and [Robert] Owen installed their own free public school system in New Harmony nine years before the state began to support public schools by taxation, and their free public kindergarten and trade school can be called the first in the western world."

Uniquely important was the wealthy Maclure's influence on vocational training through the development of the Workingmen's Institute and Library in New Harmony in 1837. When Maclure died in 1840, a stipulation in his will established 144 related educational facilities in different parts of Indiana that would provide at least a reading room as well as a lecture room with a library containing a minimum of 100 volumes. This beneficial action is rarely mentioned by modern historians, but such widespread contributions to enlightenment at the common level certainly helped pave the way for colleges and universities in Indiana.

Finally, a direct influence on college and university education came from New Harmony during the 15 years that Richard Owen was on the faculty at Indiana University (1864-79). There, he taught primarily chemistry, geology, and other aspects of natural science. From 1872 to 1874, interspersed with his full time work at Bloomington, Richard Owen was also the first President of Purdue (Day, 1986). His organizational plan, which was rejected by the new trustees, included a curriculum in which chemistry, physics, mathematics, foreign language, and English literature were required. Of course, such elements of higher education were later adopted. Thus, through Richard Owen and his firm connections with the Owenite spirit of New Harmony, both of the nascent major state universities were affected by that unique cultural gem on the banks of the Wabash.

BEGINNING AND CURRENT GENERAL STATUS OF INDIVIDUAL OLDER HIGHER EDUCATION INSTITUTIONS IN INDIANA

Against this condensed background, the development of chemistry at many of the older higher education institutions in Indiana can be traced, even though the presentation must be challengingly succinct (Day, 1992, pp. 561-591).

Ball State University. Ball State University was started as a private school in 1898, and, in 1918, it became a public institution. After passing through a number of name and status changes, its designation became Ball State Teachers College in 1929. In 1965, the school acquired university status, and the chemistry department was organized with P.A. Wiseman as its first head. Four years later, the university gained ACS accreditation for professional training in chemistry. Productivity in research became notable in the latter quarter of this century, particularly through student and faculty presentations at the annual meetings of the Indiana Academy of Science. Two of its more notable graduates in chemistry were Chester Alter (BS '27; AM '28, IU) and Jack P. Young (BS '50; PhD '55, IU).

Butler University. At its founding in 1850, the institution now known as Butler University was designated North-Western Christian University. In 1879, the name was changed to Butler University. The first faculty appointments (four) were made in 1855. These included Robert Milligan, who was the first to teach the natural sciences, including chemistry. In 1888, a department of chemistry was established. Richard B. Moore (1871-1931), one of the earliest investigators of the noble gases and radioactivity in America, was the professor of chemistry there from 1905 to 1911. Then, Moore spent 15 years away from academic responsibilities, during which he made major contributions in chemistry and became widely recognized for his work on the noble gases and radioactivity. In

1926, he returned to Indiana and academic responsibilities as Dean of the School of Science and head of the Department of Chemistry at Purdue University. There, during the few remaining years of his life, as expressed by M.G. Mellon, his great "energy, vision and leadership were soon exhibited" (Miles, 1976, p. 345). Arthur C. Cope (1909-1966; AB '29) was the most outstanding chemistry graduate of Butler. His research in organic chemistry and leadership in the American Chemical Society brought him great acclaim. Cope was born and raised in Indiana. Both Cope and Moore brought great honor to the State by being included in Miles' (1976) listing of 517 Americans, who, in their lifetimes, contributed the most to the development and progress of chemistry.

DePauw University. DePauw was founded in 1837 as Indiana Asbury University and, in 1884, became DePauw University. From the beginning, DePauw has been connected with the Methodist Church. The first catalog (1839) listed a course in chemistry, which was initially taught by Matthew Simpson, the first President of Asbury. The first major library purchase in chemistry was the highly valued four-volume reference set by Thomas Thomson, *A System of Chemistry,* which was published in 1818. Obtained by Asbury in 1839, its purchase was made possible through funds raised by the Methodists of the State to help Asbury acquire "philosophical equipment" and library resources. During the remainder of the nineteenth century, other prized chemical reference works and journals were added (Cook, 1986, p. 9), including "...the German *Berichte,* the *American Chemical Journal,* and the *Journal of the American Chemical Society.* In a few years, *Liebig's Annalen,* the *Journal of the Chemical Society,* the *Journal of Industrial Chemistry,* and *Beilstein's Handbook* were acquired." Around the turn of the century, the well-balanced chemistry library was named the P.S. Baker Memorial Library in recognition of the highly promising DePauw alumnus and teacher of chemistry, Philip S. Baker, who died in 1901 at the age of 51.

Fortunately, the loss of Baker was immediately followed by the appointment of William M. Blanchard, then at Rose Polytechnic Institute and only 28 years of age. Blanchard's appointment was facilitated by W.A. Noyes, Sr., who was then the head of chemistry at Rose. At the same time, a new building, named the D.W. Minshall Laboratory, was being constructed at DePauw. From the beginning, Blanchard had a strong influence on the development of library resources at the school. As Cook (1986, p. 10) wrote: "Blanchard's foresight in providing for this library was the cornerstone upon which rests DePauw's success as a home in a distinguished liberal arts college for the preparation of chemists." Dr. Blanchard served in chemistry at DePauw from 1901 to 1941. During his last 14 years, he was also Dean of the University. Among his innumerable decisions, both as dean of the school and head of the chemistry department, was the provision for the young and promising Dr. Percy L. Julian to conduct a fruitful chemistry research program at DePauw involving a considerable number of senior chemistry majors and graduate students. Working from 1932 to 1935, the group ultimately synthesized the pharmacologically important substance physostigmine. Their work, as stated by Cook (1986, p.16), was reported in a number of articles in the *Journal of the American Chemical Society.* Concerning the key article in the series, Cook (1986, p. 16) wrote that this "is undoubtedly the most significant publication to come from this institution."

Scores of DePauw's graduates have made important contributions in chemistry or related fields, including John M. Buchanan ('38), Herbert E. Carter ('30), George L. Clark ('14), and Percy L. Julian ('20). Three of the four also became members of the National Academy of Sciences, and all four received honorary degrees from DePauw and elsewhere in addition to various other honors and appointments to positions of high responsibility. Special honors went to Dr. Julian, including naming the Science and Mathematics Center for him and establishing the Percy L. Julian Memorial Lectureship. Much is owed to D.J. Cook (PhD'44, IU) for leadership in chemistry, beginning as a faculty member in 1945 and continuing even after his retirement. Cook was instrumental in establishing the Julian Memorial Lectureship and in stimulating even greater national recognition for this famous DePauw chemist.

Earlham College. Started in 1847 as the Friends Boarding School, this institution became a college in 1859. Chemistry has been taught there regularly since 1860. In spite of extremely limited financial resources that prevailed into the twentieth century, the dedication of the faculty and the college's loyal supporters has been notable. Two long-term teachers and leaders in chemistry at Earlham were David W. Dennis in the nineteenth century and Laurence E. Strong in the twentieth. The latter's contributions to chemical education nationwide were recognized in 1971 by the ACS. Notable among the chemistry graduates was Wendell M. Stanley (BS '26), who, with his mentor Roger Adams at the University of Illinois, published 13 papers on his graduate research. In 1934, Stanley's isolation and partial chemical characterization of tobacco mosaic virus stimulated far-reaching applications of chemistry to problems in virology. For this and related discoveries, Stanley received the Nobel Prize in Chemistry in 1946 (Miles, 1976). Equally eminent, but for different reasons, was Harrison E. Howe (BS '01). He was memorable for his lengthy and praiseworthy service as Editor of *Industrial and Engineering Chemistry* and for many other decision-making responsibilities in science and management, including membership on the board of the Purdue Research Foundation. His several honorary degrees included one from Rose Polytechnic Institute. Thus, during his lifetime, he had significant connections with three Indiana educational institutions. Howe wrote, edited, and gave innumerable lectures through most of his professional life (Miles, 1976).

Hanover College. In 1832, Hanover Academy, supported by the Presbyterian Church, became Hanover College. A chemistry course was introduced at that time. From 1879 to 1926, Andrew Young taught both chemistry and botany. As judged by Ned Guthrie, Young was "the most outstanding teacher ever connected with Hanover College" (Day, 1992, p. 573). From 1926 to about 1947, all the chemistry courses were taught by Guthrie, who devoted considerable attention to the subject both at Hanover and in his contacts with teachers throughout Indiana. The other long-term chemistry teacher at Hanover was H.K. White (BS '47, Butler; MS '50, Purdue; PhD '54, IU), who became department head in 1957. H.W. Wiley (BA 1867) was Hanover's most notable graduate. Others who became widely recognized were: C.P. Sherwin (BA '09; AM '11, IU), J.L. Culbertson (BA '17; AM '18, IU), and F.A. Guthrie (BA '50; MS '52, Purdue; PhD '62, IU).

Indiana State University. This institution began as Indiana State Normal School in 1870. In 1929, its name was changed to Indiana State College; then, in 1966, the present name, Indiana State University, was adopted. Only fragmentary aspects of chemistry were taught before 1904. In that year, E.M. Bruce (BA 1899, IU) began teaching several different chemistry courses. In 1921, Bruce was followed by P.D. Wilkinson. In 1946, some graduate courses were introduced to satisfy teacher certification requirements. By the time Wilkinson had retired in 1963, various progressive developments had occurred in the appointment of some additional professional chemists. In 1965, with the selection of W.B. Bunger as department head and the consequent broadening of course offerings in chemistry, Indiana State received ACS accreditation.

Indiana University. The establishment of a "state university" was mandated at the State Constitutional Convention in 1816. Four years later, the new State Government, by an exceedingly close vote, ordained the establishment of "Indiana Seminary" to begin "a general system of education, ascending in a regular gradation from township schools to a state university...." The first instruction, with one teacher and ten male pupils, began in 1825. In 1829, the Seminary's name was changed to Indiana College, and in 1838, the change was to Indiana University, but in name only. The first chemistry instruction started about 1830. Marked improvement occurred when T.A. Wylie came in 1837. This inveterate chemistry and physics teacher-to-be taught both subjects until 1864, when the newly appointed Richard Owen took responsibility for chemistry and Wylie continued with physics. Each had other teaching responsibilities, as described by Wylie in his remarkably informative diaries, which chronicled activities from 1832 to 1892 (copies of these diaries can be viewed either in the Archives of Indiana University or the Archives of the University's Chemistry Department). The first building for laboratory instruction in chemistry and other sciences was erected and put into use in 1840. In 1874, T.C. Van Nüys, who had received his advanced training in Germany, became the first professor of chemistry allowed to devote all his time to the subject. Van Nüys developed tuberculosis, and in 1895, he was replaced by R.E. Lyons (1869-1946), who had also received his advanced chemical education in Germany. In 1938, after 43 years as head of the department, Lyons precipitously resigned. Concurrent with this, under the beginning presidency of H.B Wells, H.T. Briscoe (1893-1960) became the first Chairman of the department. Briscoe soon became the first Dean of the Faculties and University Vice-President. As departmental chairman, he was followed in 1941 by R.L. Shriner (1941-46). About this time, the ACS made a tentative decision to grant accreditation to the university for professional training in chemistry. This decision was not finalized until 1942. The Indiana institutions accredited before IU were DePauw, Notre Dame, Purdue, and Wabash.

With the firm and equitable backing of Briscoe and others, Shriner made notable progress in strengthening chemistry and, indirectly, other sciences in the university (Day, 1992). Forty-one years later, *The Gourman Report,* a highly credible rating of graduate and professional programs, ranked the IU chemistry department fifteenth in the nation and third in the Big Ten (Gourman, 1983). High ratings have continued. For much of the twentieth century, scores of IU chemistry graduates have made notable contributions in science and/or other areas of human

endeavor. Limiting the specific identifications to eight, I judge the most influential graduates to be: Earl Blough, H.T. Briscoe, H.S. Gutowsky, F.C. Mathers, Frank P. Popoff, W.L. Roelofs, W.J. Sparks, and J.C. Warner. Along with numerous other honors, Gutowski and Roelofs received the National Medal of Science in 1977 and 1983, respectively (Day, 1992).

Consideration of chemistry and the chemists at other campuses within the IU System has been omitted, because these programs are still quite young.

Manchester College. Manchester College was founded in 1889, and since 1895, it has been under the auspices of the Church of the Brethren. Progress toward a significant department of chemistry was begun in 1911 by Edward Kintner, whom the record indicates taught chemistry and, at different times, some other subjects, including entomology, botany, physics, zoology, and genetics. After 1923, when chemistry and physics became departments, Kintner gave considerable time to the biological sciences. In 1923, Carl W. Holl was made the first Chairman of chemistry. One of the national honors awarded to Holl, which reflected favorably on the college, was his selection by the ACS in 1958 as one of six college teachers to receive the Manufacturing Chemists Association Award for the outstanding teaching of chemistry. From 1957 to 1970, Harry R. Weimer was the Chairman, and, like his predecessors, he taught the various introductory courses that were offered. Weimer was succeeded by Edward G. Miller. Of the chemistry graduates of Manchester College, who attained distinction, the most notable was Paul J. Flory (BS '31), who received the Nobel Prize in Chemistry in 1974. Flory was also awarded the National Medal of Science in 1975. He is known for his work with synthetic fibers, rubber, and other polymeric substances. Another noted graduate was Ray J. Plunkett, who discovered Teflon in 1939. For this achievement, Plunkett was named to the National Inventor's Hall of Fame in 1985. Other graduates include Clem Miller, Clarence M. Neher, Paul E. Weimer, and Wendell W. Meyer.

Purdue University. As a result of the Morrill Act of 1862 and the generosity of John Purdue, Purdue University opened in 1874 to provide an agricultural and technical education. The first professor of chemistry was H.W. Wiley, who had also spent a short time on the faculty of what is now Butler University. Wiley concentrated on analytical chemistry, particularly sugar analysis and the detection of adulterated foods. Wiley left Purdue in 1883 to work for the Federal Government developing guidelines for the purity and safety of foods and drugs.

The most notable of all the Purdue chemistry faculty is H.C. Brown, who won the 1979 Nobel Prize in Chemistry and the 1980 ACS Priestley Medal. Another well-respected Purdue chemist was M.G. Mellon (1893-1993), who joined the faculty in 1919 and remained active until just before he died. Two widely recognized and highly honored agricultural biochemists at Purdue are E.T. Mertz and R.L. Whistler. Mertz was a codiscoverer of high lysine corn; Whistler worked in polysaccharide chemistry. A large number of Purdue's chemistry alumni have been recognized for their accomplishments. H.N. McCoy (1870-1945) is especially notable. Among his achievements was the proof that radioactivity is an atomic property. McCoy won the Willard Gibbs Medal in 1937. Each year, Purdue presents the Herbert Newby McCoy Award for the

greatest Purdue-connected contribution of the year in science. Mertz received this award in 1967.

Consideration of chemistry at Purdue's regional campuses was omitted because these programs are still quite young.

Rose-Hulman Institute of Technology. Founded in 1874, the school was first called Rose Polytechnic Institute. The current name was adopted in 1971. Although the first degrees in chemistry, physics, and mathematics were awarded in 1960, courses in these fields were offered almost from the beginning of the Institute. Over the years, several of the chemistry teachers at Rose became widely recognized. The most noted was W.A. Noyes, Sr., who taught there from 1886 to 1903. During this time, his son, W.A. Noyes, Jr., was born in Terre Haute. Among the honors eventually shared by both father and son was the Presidency of the ACS. Both were long time Editors of the *Journal of the American Chemical Society* and *Chemical Reviews.* In 1932, the two co-authored the book, *Modern Alchemy.* During the elder Noyes' last two years at the Institute, Austin M. Patterson was a member of the chemistry faculty. By 1909, Patterson had become Editor of *Chemical Abstracts,* a position he retained for many years. Faculty leadership at Rose-Hulman has remained strong. Among its better known chemistry graduates were Norman Cromwell (1935) and E.R. Davidson (1958). Both were born in Terre Haute. The latter received his PhD from IU.

Taylor University. The institution was organized as the Fort Wayne Female College in 1846. In 1890, control passed to the National Association of Local Preachers of the Methodist Episcopal Church. At that time, the present name was adopted in honor of Bishop William Taylor. Apparently, the first Taylor chemistry instructor, who held a PhD in chemistry, was G.H. Evans. He was in charge of chemistry at Taylor from 1933 to 1941. S.L. Burden (PhD '66, IU) has been responsible for chemistry there since 1979. Aided by student researchers, Burden has worked on improving portable blood electrolyte analyzers as well as a number of other projects. Burden's overall research objective is improvement of biosensor technology having clinical applications.

University of Evansville. This university opened in 1919 under Methodist sponsorship as Evansville College. In 1967, it became the University of Evansville. The now defunct Moores Hill College was its predecessor. From 1921 to 1954, dynamic and meticulous Alvin Strickler was head of the chemistry department. During this period, the chemistry department became one of the strongest in the college. Lowell E. Weller became department head in 1957. Soon thereafter, ACS accreditation for professional training in chemistry was attained. A substantial number of the graduates became productive in chemistry. Ralph L. Seifert (AB '34), who joined IU's chemistry faculty in 1949, had the greatest success both in teaching and research (Day, 1992).

University of Indianapolis. In 1902, Indiana Central College was established by the United Brethren Church, which later merged with the Methodist Church. About 1990, the school's name was changed to the University of Indianapolis. No sustained program in chemistry existed until the appointment of Robert Brooker in 1951. Brooker retired in 1968 and was succeeded by Kenneth Borden. Since 1946, all the chemistry courses offered have been taught by chemists.

University of Notre Dame. This institution was founded by the Catholic Church in 1842. Chemistry was first taught around 1852. The first special course was qualitative analysis, started in 1874 by Rev. Joseph Carrier. (In that year, qualitative and quantitative analysis also became the focus of attention at IU and Purdue.) *The Centennial of Science at Notre Dame, 1865-1965* was celebrated in 1965. Dr. Milton Burton was the Chairman of the Centennial Celebration. A comprehensive but succinct historical record was published. A widely appreciated member of the chemistry faculty, L.H. Baldinger (1965, pp. 28-32), was the principal contributor concerning the Department of Chemistry. The year 1865 also marked the beginning of a curriculum in science leading to the degrees of Bachelor of Science and Master of Science. In 1940, the joint administration of chemistry and chemical engineering was discontinued. Some of the department heads or chairmen beginning in 1945 included C.C. Price, G.F. D'Alelio, E.L. Eliel, J.L. Magee, J.P. Freeman, R.K. Bretthauer, and T.P. Fehlner. Interdisciplinary programs closely linked the Radiation Laboratory with several faculty members in the Department of Chemistry, including Milton Burton, who was Director until he retired in 1971. The most outstanding chemist at the university was Rev. Julius A. Nieuwland, who, beginning as a student in 1904, worked both in botany and chemistry. His landmark research on acetylene in the early 1920s led him to become director of research in organic chemistry. In 1926, he "disclosed his now-famous catalytic polymerization of acetylene which gave rise to the basic patents in the manufacture of Neoprene" (Baldinger, 1965, p. 30). The royalties from this work were used in several beneficial ways at Notre Dame, including the funding of a major proportion of the construction costs for the Nieuwland Science Hall (Day, 1992).

Valparaiso University. This institution is the outgrowth of a succession of small, for-profit schools, the first of which opened in 1859. Apparently no laboratory instruction occurred prior to 1874. In 1925, the Lutheran Church became the not-for-profit owners. Within four years, many departments, including chemistry, were created. Among Valparaiso's prominent chemists were R.G. Larson, head of the department from 1951 to 1956 and the recipient of a PhD from Purdue in 1937; T.C. Schwan (1957-1959), who received his PhD from Notre Dame in 1953; and J.F. Deters, who was the chairman from 1965 to 1970. B.L. Ferguson (AM '50, IU) joined the Valparaiso faculty in 1950 and remained there throughout his professional life. A.G. Cook became chairman in 1970. The institution is now accredited by the ACS for the professional training of chemists. Among the notable graduates of Valparaiso were L.P. Hager (AB '47) and Edith Schroeder Lessor (BS '52; PhD '55, IU).

Wabash College. This school was founded in 1832 and is unique in retaining both the same name as well as its policy of admitting only male students up to the present time. From the mid-1830s to the mid-1870s, only one person, E.O. Hovey, taught chemistry (along with a number of other courses). Primary attention was given to qualitative and quantitative analysis. Some of the other chemists, who taught at Wabash between Hovey and R.G. Miller (who was hired in 1982) were H.R. Thomson, E.R. Lewis, Alexander Smith, W.E. Chamberlain, W.O. Emery, J.B. Garner, J.M. Breckenridge, C.H. Johnson, F.C.M. Smithson, L.R. Howell, E.L. Haenisch, and P.C. McKinney. Howell and then Haenisch did

the most to advance professional chemistry. Hovey and his wife, Mary Carter Hovey, were notable in attracting large gifts to the college. Haenisch had a national reputation in chemical education. Some of the most prominent chemistry alumni included T.W. Mastin, long-time President of the Lubrizol Corporation; R.S. Schreiber, Vice President for Research in the Upjohn Company; and W.J. Haines, Director and Executive Committee member of the Johnson and Johnson Company (Day, 1992).

PERSPECTIVES ON THE STATUS AND PROSPECTS IN CHEMICAL EDUCATION AND RESEARCH REFLECTED IN RECENT GRANTING OF CHEMISTRY DEGREES IN INDIANA

Table 1 clearly illustrates through the number of degrees awarded that ample opportunity exists for learning about chemistry at many of the colleges and universities in Indiana. Presumably, the data for other disciplines would be comparable. Moreover, both the private and public sectors of higher education are contributing significantly now as they have in the past. Such balance is very important.

Table 1 also shows the remarkable degree of cooperation which prevails between public institutions, especially IU and Purdue, in providing comprehensive training in chemistry in different parts of the State. The large campuses at Fort Wayne and Indianapolis are connected to both Indiana and Purdue. Regional campuses accredited by the ACS for professional training in chemistry include Indiana University Northwest, South Bend, and Southeast. Calumet is an accredited member of the Purdue System.

In all these colleges and universities, from their inception to the present time, a liberal arts perspective has been required for graduation in chemistry and related disciplines. Such breadth of preparation should be maintained.

However, a lamented deficiency is the lack of adequate, readily available histories of chemistry and related disciplines for many schools. Even a short booklet, such as D.J. Cook's (1986) regarding the history of chemistry at DePauw, has much merit. Such records are needed to aid future historians and academic planners.

ACKNOWLEDGMENTS

I am indebted to one or more persons, each affiliated with one or more of the institutions surveyed, who furnished information which was indispensable. Also, I am grateful to Gary Dolph and others for editorial suggestions and directions. But only I am responsible for any errors, oversights, and faulty judgments. I do appreciate the extended panorama of developing academic chemistry in Indiana this study has afforded. It was worth the effort.

LITERATURE CITED

Baldinger, L.H. 1965. The centennial of science at Notre Dame, 1865-1965. 2. Department of Chemistry, pp. 28-32, Univ. Notre Dame, South Bend, Indiana, 112 pp.

Bigney, A.J. 1916. A century of science in Indiana. Proc. Indiana Acad. Sci. 32: 48-260.

Cook, Donald J. 1986. Chemistry at DePauw University 1837-1987. A sesquicentennial historical pamphlet. DePauw Assoc. Chem., 48 pp.

_____. 1994. The high calling of sciences. Eighteenth annual Percy L. Julian Memorial Lecture. DePauw University, Greencastle, Indiana, 16 pp.

Daily, W.A. and F.K. Daily. 1984. History of the Indiana Academy of Science, 1885-1984. Indiana Acad. Sci., Indianapolis, Indiana, 249 pp.

Day, H.G. 1986. Survey of the lives and careers of three charter members of the Indiana Academy of Science: Theophilus A. Wylie, Richard Owen, and Harvey W. Wiley. Proc. Indiana Acad. Sci. 95: 355-362.

_____. 1992. The development of chemistry at Indiana University, 1829-1991. Dep. Chem., Indiana Univ., Bloomington, 668 pp. (Available through the office of the Chairman.)

Esarey, Logan. 1915. A history of Indiana from its exploration to 1850. W.K. Stewart Co., Indianapolis, Indiana, 515 pp.

Gourman, J. 1983. The Gourman report. A rating of graduate and professional programs in American and international universities, 2nd ed. Nat. Educ. Standards, Los Angeles, California, 176 pp.

Miles, W.D. 1976. American chemists and chemical engineers. Amer. Chem. Soc., Washington, DC, 544 pp.

Ross, L. 1993. ACS committee on professional training 1992 annual report. Chem. Eng. News. 71: 24-33.

_____. 1994. ACS committee on professional training 1993 annual report. Chem. Eng. News. 72: 72-79.

Visher, S.S. 1951. Indiana scientists. A biographical directory and an analysis. Indiana Acad. Sci., Indianapolis, Indiana, 286 pp.

Wilson, W.E. 1964. The angel and the serpent. The story of New Harmony. Indiana Univ. Press, Bloomington, Indiana, 242 pp.