Remembering High School Chemistry

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I first met Harry Johnson in the fall of 1963 when I registered for his fourth-period chemistry class my sophomore year at Wausau Senior High School. I had been looking forward to this event for some time. Ever since the 5th grade, when I first became interested in chemistry, I had been building a home laboratory and, in Junior High School, the science director, Mr. Klipstein, had allowed me to convert one of the back rooms to his classroom into a similar laboratory, where I had taught myself the rudiments of chemical analysis and had won several science fairs under his tutelage. But, from my limited perspective, all of this seemed like small potatoes. High School was the big time – no more general science classes taught by general science teachers with only a passing knowledge of chemistry, but a real chemistry course taught by a trained chemist. This anticipation was also mixed with a certain amount of dread. A fellow amateur chemist by the name of Raymond Fraedrich, who was a year older than me, had just completed Harry's course and had found it tough going. With barely concealed malevolence, he had predicted that I was soon to meet my chemical Waterloo.

When I first set eyes on Harry, he was in his mid-sixties. Short and bald, with narrow, slightly crossed eyes, he had the aura of a mischievous, albeit not necessarily benevolent, elf about him. He appeared to have only two modes of dress: either a short, light-brown lab jacket, which he always wore when teaching, or a combination plaid jacket and oversized beret covered with badges and medals won by the high school curling team – a sport which only those driven to despair by the long, dark, frigid days of a Wisconsin winter could come to know and love, but which Harry had coached with great enthusiasm for nearly half of his teaching career.

Born in 1899 in Stetsonville, Wisconsin, he had been trained in chemistry at Ripon College, where – or so he repeatedly told us – he had been a classmate of the future film sensation and heart throb, Spencer Tracy. By 1963 Harry had been teaching chemistry at Wausau Senior High School for nearly 40 years, having taken the job in 1923. He was something of an institution, and it seemed that all of the parents of my friends who had been raised in Wausau remembered having had him for chemistry at some time in their long-vanished youth.

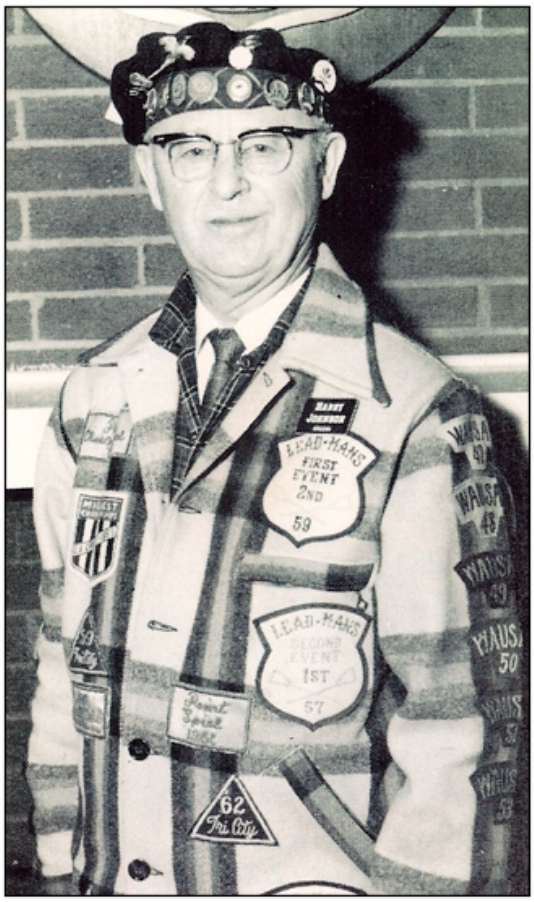
Harry A. Johnson
(1899-1992)

For the first few weeks of class, it seemed to be a toss up whether Raymond's dire predictions would come true. The first day Harry had appeared with two cheap, cartoon-like, plastic dolls with puckered lips – one male and one female – which looked like they had been purchased at a novelty shop sometime in the 1940s. He placed them on the demonstration desk about six inches apart and let go of them. They obviously had strong magnets in their heads and they immediately slid together in a plastic lip lock. "That," Harry proudly announced, "is chemistry!" Then, as if to emphasize the significance of this remark, he made a

sweeping gesture with his right hand and proceeded to accidentally knock several pieces of glassware into the sink.

A similar ambivalent message was conveyed by the first examination on which Harry asked us to use the metric system to calculate the volume of dirt contained in a hole 50 centimeters x 1 meter x 800 millimeters. We all dutifully sweated through the necessary conversions only to find, when the exams were returned, that we had all gotten the answer wrong, because, as Harry proudly announced to us, everyone knows that there is no dirt in an empty hole. This was profoundly disturbing, not because we didn't appreciate the joke, but because Harry was constantly making mistakes on his exams and, for the rest of the year, we could never be certain whether we were dealing with an unintentional typo or with another trick question.

The first week Harry also requested that each student bring three empty wax milk cartons to class. The purpose of this odd request became apparent as the year progressed. It turned out that Harry dearly loved explosions, and any gas – methane, hydrogen, ethene, acetylene, nitrous oxide, or carbon disulfide vapor – that could be mixed with oxygen to form an explosive mixture, was duly demonstrated. The usual drill was to mix the gas or vapor in question with oxygen in one of the empty wax milk cartons, place it on a metal tripod inside a packing crate set on one end with the open top facing the students, and ignite it with a burning splint taped to the end of a meter stick. If the ensuing explosion was particularly violent, Harry would tape two meter sticks together and crouch behind the demo desk wildly waving the burning splint in the general direction of the packing crate while the class cowered at the back of the room. Often he would do two of these explosions per period, six times a day. I still remember sitting in English class, when, for at least the tenth time that day, a muffled explosion came from the third-floor chemistry laboratory. The English teacher stopped midsentence, slammed her book down on the lectern, and bellowed, "That God damn fool is at it again!" We all sat there stunned. In the 1960s teachers never used phrases like "God damn fool," or at least not in front of students.



Harry in his curling regalia.
He coached the curling team for 17 years.

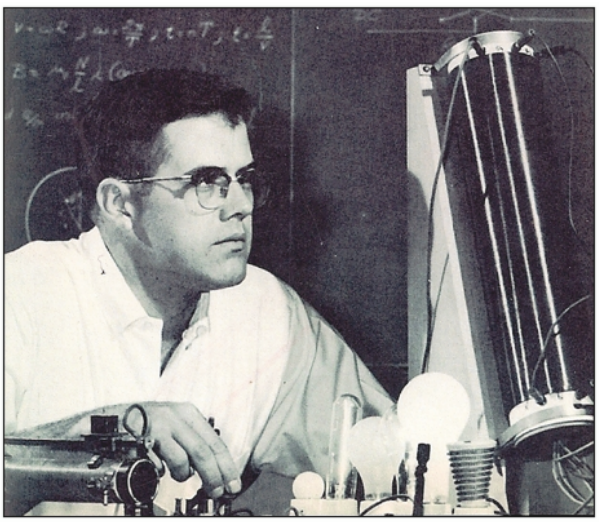
The exploding milk carton, however, was not Harry's *piece de resistance*. That was his device for demonstrating how an internal combustion engine worked. It consisted of a six-inch length of iron pipe, one end of which was welded to a metal plate. Half way down the pipe an automobile spark plug was set into the wall. Harry would fill the pipe with a few drops of gasoline, cork the open end, and warm the outside cautiously with a Bunsen burner to ensure vaporization. He would then set the device on its side with the cork aimed down the center of the room (the class having pressed itself against each of the classroom walls), and touch the spark plug with an induction coil. The result was a violent explosion followed by a cork firmly embedded in the back wall of the room, where the numerous matching holes provided mute evidence to the continuing success of the device.

Not all of Harry's memorable demonstrations involved explosions. Bleaching was another favorite topic, whether done using chlorine gas, ozone, or sulfur dioxide. On these occasions he would wear a very broad, and very ugly, necktie dating from the 1940s to class, and each period would snip off a piece of it using a pair of scissors and proceed to bleach it. By the end of the day he was running around with only an inch or two of cloth dangling beneath the tie knot. Indeed, many of his nonexplosive demonstrations were of the practical household hints variety and involved such topics as the electrolytic cleaning of silverware and the making of tooth paste. He always maintained that the commercial versions of the latter product were a sham and a rip-off as the active cleaning and polishing in-

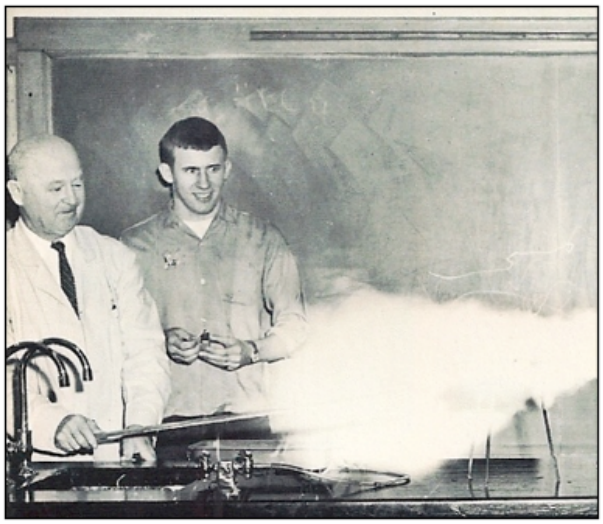
gredient was actually fine sand, and he further claimed that he was going to make a fortune when he retired by manufacturing it in his basement.

His few attempts to directly involve students in these demonstrations were not always a resounding success. On one occasion Harry had a student come to the front of the class and taste a very dilute solution of hydrochloric acid. When he asked the student what it tasted like, the student replied "horrible." "Wrong," said Harry, who was looking for the textbook pronouncement that acids taste sour, "Try again." Back came the answer "terrible," then one more try and the answer "bitter." By this time the student could barely talk, so Harry had him rinse his mouth out with lime water and they started over again. After another four incorrect adjectives and another rinsing with lime water, the now incoherent student was finally allowed to sit down and Harry, his mind no doubt filled with black thoughts concerning the academic decadence of the younger generation, provided the missing adjective himself.

As things turned out, Raymond's predictions of my impending academic doom proved false. I easily got an A in Harry's class and soon became, as I now retrospectively realize, the teacher's pet. On several occasions Harry even allowed me to lecture to the class, though he kept this to a minimum, no doubt realizing that I was risking death at the hands of my fellow students. Most of the time, however, he allowed me to skip class and to spend the hour in the back room instead. This was a small combination office and stockroom separating the two chemistry classrooms on the third floor of the 1937 wing of the high school. The south classroom was Harry's domain and the north



Art Hagemann posing with a nonsensical arrangement of apparatus for the student yearbook.



Harry with lab jacket, meter stick and explosion.

classroom belonged to Arthur Hagemann (of whom more in a bit).

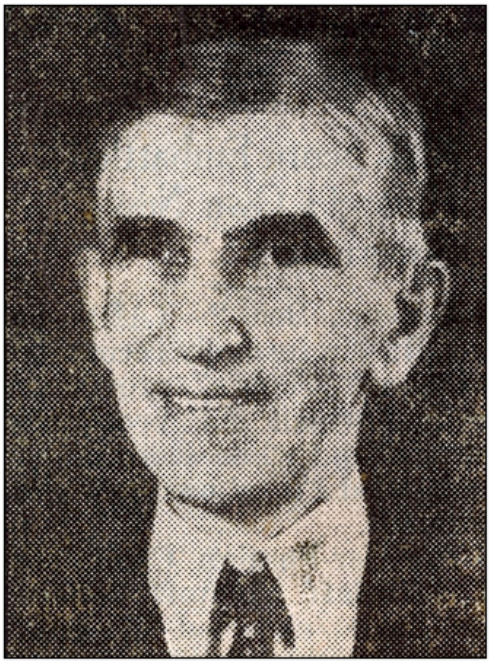
Despite the date of the building, this back room had a definite 19th-century feel to it, since most of the bead-board cabinet work and chemicals – virtually all of them in corked or glass-stoppered bottles purchased from Germany before the First World War – had been transferred from the older 1898 high school building, which was still being used and which was connected to the newer section by means of an enclosed walk over. Here I would spend the class hour, as well as after school, conducting experiments of my own devising or reading the various advanced chemistry texts belonging to Harry and Art that were stored there. Harry was also aware that I was an avid home chemist and would often give me chemicals and old equipment for my home laboratory, much of it dating from the late 19th century. Fortunately many of these items survived my home experimentation and are now preserved in the Oesper Museum of Chemical Apparatus in Cincinnati. At the end of the year, he made me a present of an inscribed copy of the mathematical tables from the *Handbook of Chemistry and Physics*, which I still own and use in my own teaching.

My junior year was Harry's last year of teaching and, when he retired in the spring of 1965, I inherited many of his books and files. These included his personal copy of the 1931 edition of Charles Dull's *Modern Chemistry*, which Harry had used, in one form or another, as a textbook for most of his teaching career at Wausau Senior High. First published in 1918, the book had been kept in print for more than 40 years through a process of continual revision and updating, and we had used its direct descendent, the 1958 text, *Modern Chemistry* by Dull, Metcalfe and Williams, the previous year.

This traditional approach to chemistry, with its emphasis on industrial and household applications, stood in sharp contrast to the modern *CHEM Study* course taught by Art Hagemann. Cobbled together by the American Chemical Society to undercut the challenge of the truly innovative *Chemical Bond* or *CBA Approach* to high school chemistry, *CHEM Study* was essentially a watered down college course with extensive doses of the inductive laboratory approach inserted. The textbook was relentlessly dull in a way that can only be achieved when something is put together by committee mandate, and the inductive exercises were insultingly artificial. I remember Steve Weiner and Jim Smit, of the class of 1965, making fun of the course in debate class. One of the laboratory exercises involved the examination of a small black box with several unknown objects inside (either pennies or paper-clips, I believe). By shaking, weighing, and otherwise fooling with the box (but without opening it), the students were suppose to construct a feasible model of what the objects inside might be like. The idea was to parallel the process of inductive model building with respect to atoms and molecules, which were likewise inaccessible to direct observation. As members of the Lyceum philosophy club, founded by my friend, Tom Schwartz, Steve and Jim were bored by this game and instead contrived a laboratory report in which they purported to have deduced that the box contained Leibnizian monads. Rumor had it that Art was not amused by this satire.

My younger brother also took *CHEM Study* from Harry's successor the first year I was in college. I can still remember him asking for help and, each time I gave him the answer, his plaintive wail of "But we're not suppose to know that yet." I doubt if any student ever worried more about what he was not suppose to know at any given time than did my poor brother during that year of inductive chemical hell.

The original 1898 high school building. Chemistry and the other sciences were originally located on the third floor and shared an elevated lecture hall located in the large dormer above the main entrance.



Anton P. Minsart
(1870-1938)

It turned out that, among the items given to me when Harry retired, were many of the books and files (including an obituary) of his predecessor, Anton P. Minsart. Born in 1870 in Brown County, Minsart had taught at several Wisconsin high schools before obtaining a degree in chemistry from the University of Wisconsin at Madison. In 1918 he became head of the science department and chemistry teacher at Wausau Senior High, where he remained until his retirement in 1936. At that time the chemistry department was located on the third floor of the 1898 high school building and sported an elevated lecture hall located in the huge dormer directly above the main entrance. Most of the chemicals and equipment that Harry gave me for my home laboratory had been purchased by Minsart and, like them, his books now reside in the Oesper Collections in the History of Chemistry at the University of Cincinnati.

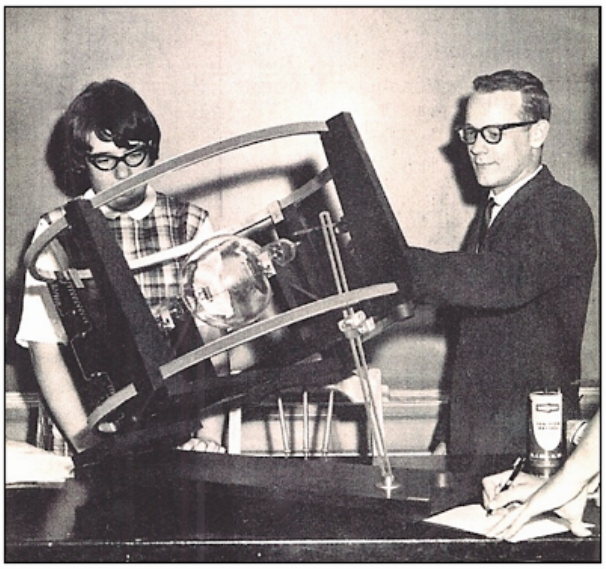
Though I continued to haunt the back room of Harry's classroom in my guise as president of the chemistry club, the official academic commitment for the junior year was to the physics course taught by Jon Harkness. Somehow Newton's laws of motion did not lend themselves to the spectacular exhibitionism that Harry had specialized in, and the anecdotes for this year are correspondingly muted. I do recall, however,

that Karl Stahmer tried teaching himself calculus that year, though apparently with little success, as Jon would repeatedly chastise him for trying to use his newly discovered art on his physics exams.

In the physics classroom we sat at small tables that faced the front of the room. These were originally designed to seat two students, one on each side of a small central storage cabinet located beneath the table. However, due to overcrowding, a third student had to be seated in front of the cabinet door at many of the tables. At one of these tables, this third student developed the habit of wedging his chair at a 45 degree angle between the cabinet door and the table immediately behind. One day, as a joke, several of the students unhinged the cabinet door on this table before class and then set it carefully back in place. When class started, the student in question rotated his chair back into its familiar 45 degree position. I believe it took a full five minutes for the door to finally give way and for the student and chair to slam loudly on the floor. It was a brilliant demonstration of the law of leverage, though one that was thoroughly unappreciated by Jon and, in retrospect, an extremely dangerous prank. The distance between tables was not great and the fall snapped the back of the chair. Why it didn't break the student's back as well is a mystery to me. It is a wonder that any of us survived the stupidity that passes for adolescent male humor.

The best opportunity for applying the chemical wisdom imparted by Harry came, however, not in Jon's physics class, but in Brian Bennett's "American Problems" course our senior year. The realities of the Vietnam War and the impending countercultural revolution

The officers of the chemistry club for 1965 hanging out in Harry's back room. The author is on the far right.



Jon Harkness demonstrating J. J. Thomson's apparatus for determining the charge to mass ratio of the electron.

were still distant rumbles in Wausau, Wisconsin, in the early 1960s, and Bennett's views on politics and teaching were considered a tad too liberal by our rather limited standards. It was Bob Vorwalske, I think, who first suggested – shortly after Bennett announced that we would be reading the *Communist Manifesto* for his class – that we should rename the well-known acid-base indicator, phenolphthalein, "Brian Bennett Pink" in his honor. This was enthusiastically endorsed by all concerned. Performing a titration soon became known as "conducting a Congressional hearing," and titration to the endpoint – the point at which the pink color of the indicator no longer faded – became known as the "smearpoint." I hasten to add that there were no heartfelt political convictions behind these euphemisms. It was nothing more than opportunistic adolescent sarcasm and was applied indiscriminately to both ends of the political spectrum.

Like myself, Bob was one of several students who wrote for *Subversive*, a student-produced magazine of local and national political satire which we published intermittently throughout our high school days in the attic of Doug Johnson's house on McIndoe Street, initially using a gelatine hectograph and later using a circa-1920 mimeograph machine that Ken Maaske and I had purchased for $10.00 at Mr. K's Junk Shop, which was located behind the Sears Store just off main street.

By their senior year, the science nerds of the high school had run out of science courses. We had all taken biology in Junior High School, chemistry our sophomore year, physics our junior year, and nothing else

was in the offering. To meet this challenge, Jon Harkness and Art Hagemann put together an advanced course for us entitled “Integrated Science.” Just off the huge study hall (306) at the north end of the third floor there was a metal door labelled 308. After a jog through a small entry way, this led into a long, very narrow, room that spanned the entrance to the school auditorium. This we were given for our new course. The room, when we inherited it, was empty save for a single object – a large marble-fronted box with a coil projecting from the top. Labeled an “Odin Resonator,” it looked like something left over from the set of the original 1931 movie version of Frankenstein. It had been apparently donated to the physics department by the telephone company sometime in the 1920s and was designed to generate high-voltage electrical sparks several feet in length. We had two electrical prodigies in our class, Blair Peshak and Gary Meyer, who immediately began vying for control of this device. I recall them taking it apart to clean and discovering an enormous oil capacitor inside and the fact that the circuits were formed of quarter-inch solid copper tubing rather than wire. An article in the school newspaper entitled “Special Classroom, Special Class, Accommodate Future Science Wizards” shows a photograph of the class gathered around this device as Gary draws a foot-long spark from the coil and Blair watches from the side with a look on his face far more lethal than the spark that Gary is coaxing from the resonator.

As suggested by its name, integrated science was intended to be one third advanced biology, one third advanced chemistry, and one third advanced physics, with a few weeks of history of science thrown in. But, aside from a talk by one of the biology instructors on the role of induction in science, during which he was challenged by several Sherlock Holmes fans in the class, who claimed that science was really deductive, I have no recollection of anything but the physics portion of the course. I recall repeating J. J. Thomson's measurement of the charge to mass ratio of the electron, the Millikan oil-drop experiment, and the famous Michelson-Morley ether-drift experiment, of playing with ripple tanks and confirming Newton’s laws of motion using frictionless metal “hockey” pucks that traveled on a layer of carbon dioxide gas provided by a chunk of dry ice placed on top. And I recall watching a three-minute movie made by a physics teacher in Brooklyn of a flea dragging one of these two-pound frictionless pucks across a table top.

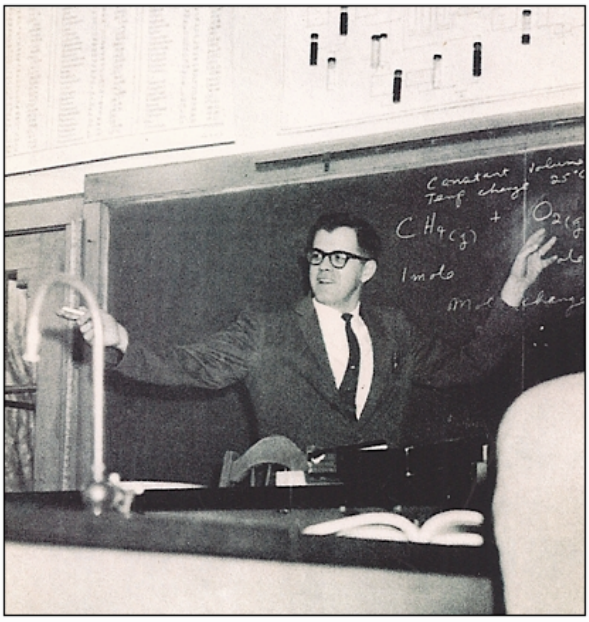
And then, of course, there was our brief fling with

Jon Harkness caught in a typical teaching posture.

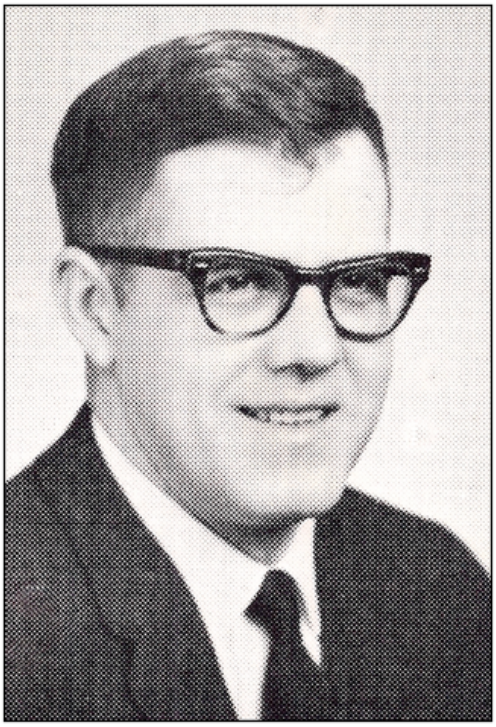
Members of the integrated science class look on as Gary Meyer draws a spark from the Odin Resonator. Blair Peshak is on the left and the author on the right.

astronomy. Several evenings a week Jon would come into school to grind mirrors for a project related to his master's degree, and he would allow several of us – as members of the school's astronomy club – to accompany him so that we could take the departmental telescope up to the roof of the school. After looking at the moon, at Jupiter, and at the rings of Saturn, we soon discovered that one star basically looked like another, at least at the magnification available to us. It was at this point that someone remembered that one of the school cheerleaders lived in a house across the street. Since such creatures were as far removed from the realm of science nerdom as were the stars we had been looking at, it was immediately decided that she qualified as a legitimate astronomical object. As it turned out, all we could see from our position was the top of the house and one attic window. Nevertheless, it was while we were engaged in this fruitless search for more interesting objects of observation that Jon appeared on the roof to check up on us. Having been caught in *flagrante delicto*, so to speak, our telescope privileges were immediately suspended.

The last part of the integrated science course was spent on individual research projects. I worked with Art on developing a sulfide-free scheme for qualitative chemical analysis, and can only remember one of the other projects. For some reason that escapes me, Richard Koch decided to do a study involving the use of sterilized female white mice. Unfortunately it is not easy to determine the sex of white mice by external examination only and Richard, who wore very thick glasses, ended up removing the intestines from several male mice under the mistaken impression that he was removing the ovaries from female mice. I am sure it comes as no surprise that the project was not a resounding success due to an abnormally high mouse mortality rate.



Art Hagemann holding forth on the stoichiometry of methane combustion.



Arthur J. Hagemann
(1931-1991)

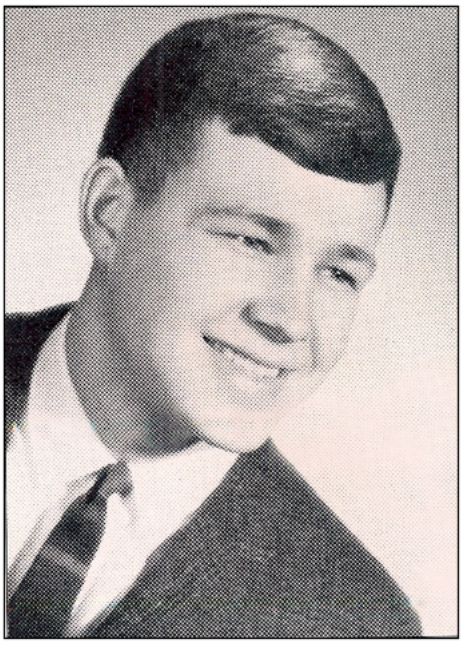
Art Hagemann was nearly 30 years younger than Harry. Born in 1931, he had received his chemical training at the University of Wisconsin, after first serving in the Korean War. Like Harry, he seemed to have only one mode of dress – a somewhat dated dark blue, double-breasted suit, which he always wore unbuttoned, though he usually preferred to teach in his shirt sleeves. He smoked a pipe; wore an angler's hat with the brim turned down; drove around in a tiny, beat-up, blue Renault; and raised honey bees as a hobby.

Though I never saw Harry again after his retirement, I did keep in touch with Art. During my years in Madison, I would occasionally visit him at the old high school and later at the newer high school on the west side. In this way I also got to know Harry's successor, John Ihde, who was the son of Aaron Ihde, an internationally known authority on the history of chemistry, and one of my professors at the University of Wisconsin. The last time I saw Art was in the summer of 1988 when he, John, and Aaron Ihde all attended the 10th Biennial Conference on Chemical Education at Purdue

University, where I was chairing several sessions. We had lunch together and thoroughly enjoyed reminiscing about former times. Three years later, John informed me that Art had driven home during the noon hour to have lunch as usual and had died of a sudden heart attack. He was 60 years old. Harry, as I later found out, actually outlived him, not dying until 1992 at the age of 93.

Looking back on 30 years of my own teaching, I now realize how lucky we were to have been high school students in the 1960s. We were the end product of the Sputnik era and benefited by a brief period of government-sponsored emphasis on excellence in science teaching. Looking at the yearbook for my senior year, I find that three of us – myself, Michael Kluetz, and Paul Wollenzien – all listed chemistry as our future occupation. All three of us attended the University of Wisconsin at Madison, all three received doctoral degrees in chemistry, and all three became university professors. I also find that Ben Sternberg listed science as his future occupation and Blair Peshak listed electrical engineering. Ben earned a doctorate in physics, and Blair not only completed an engineering degree at Wisconsin, but went on to play an important role in designing some of the first IBM personal computers.

When interviewed after his retirement in 1936, Harry's predecessor, Anton Minsart, made two observations about his experiences as a chemistry teacher: 1) the students in his early days had been better than those later on, and 2) the girls were generally better students than the boys. I wonder what Minsart would have thought of our integrated science class. Would he have revised his opinion, at least with respect to his first observation? As for the second, we would have been of no help whatsoever. In the 1960s, at least, science nerdism, like autism, was still a predominantly male affliction.



John A. Ihde