Report of

Sixth Biennial Conference on Chemical Education

Rochester Institute of Technology
National Technical Institute for the Deaf
June 22–26, 1980

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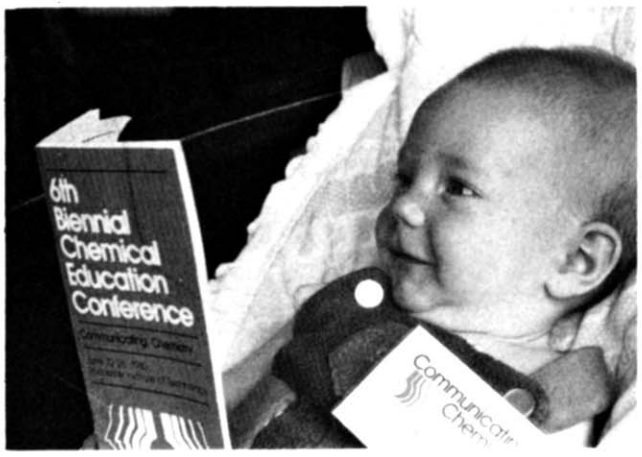

Introduction

Rochester was a hit! But which Rochester? The Sixth Biennial Conference included 127 papers in three days. There were often several parallel sessions and few participants actually attended one and the same sequence of formal sessions, let alone the many informal small group huddles. There were many aspects of attending the Conference about which widespread participant agreement would be readily forthcoming: the smooth organization, the genial hospitality, the high quality of the food, and the cordiality of the students at the National Technical Institute for the Deaf.

Each morning and afternoon time block began with a stand alone session, but Tuesday morning was the only multihour time block with a single activity for all participants. On Tuesday afternoon there were as many as six parallel nonrepeated activities from which participants could choose to attend.

Readers are cautioned that before participants were half way through the experience they had come to use the term "intense" when describing the Rochester experience. There were rarely resting, unfilled moments.

This conference report was prepared as the result of efforts by twenty-nine reporters, photographers, and editors whose names, initials, and affiliations are listed below. Since 127 papers were actually presented at the conference, it is impossible to do justice to them in the space available. Our report attempts to reflect the essence of each contribution in just a few sentences. Additional information can be obtained from the conference abstracts, "Notes 6th," copies of which can be obtained for $12 each from Dr. Earl Krakower, Department of Chemistry, Rochester Institute of Technology, Rochester, New York 14623. In preparing the text of this report, only the name of the presenting author has been given followed by the paper number from "Notes 6th" and the initials of the reporter. Full titles and all authors are listed by paper number at the end of each section.

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Contributions . . . Gratefully Acknowledged

American Chemical Society
Division of Chemical Education
PRF-SEO
Rochester Section
Eastman Kodak Company
Pennwalt Corporation
Proctor and Gamble Company
Dupont Company
Celanese Corporation
Union Carbide Corporation
Mobil Oil Company
GTE Sylvania
University of Rochester
Laboratory for Laser Energetics
Chemistry Department
Dynalab Corporation, Rochester, New York
Visual Horizons, Rochester, New York
Rochester Institute of Technology
President's Office
College of Science and Department of Chemistry
National Technical Institute for the Deaf
Perkin-Elmer Corporation
State of Connecticut, Housatonic College
Columbia University, Department of Chemistry

Chemical Exposition

American Chemical Society
Bausch and Lomb
J. G. Edwards Co.
Oxford University Press
Perkin Elmer Corp.
Sargent Welch Scientific Co.
Sybron Laboratory Products
John Wiley and Sons, Inc.
National Science Foundation
Programs for Learning, Inc.
Worth Publishers, Inc.

Contemporary Issues Related to Chemistry

Some areas of great technical interest to chemists are in the public spotlight today. The conference organizers arranged for speakers in many such areas. There were several contributed presentations in these areas as well. The formal publicity of the conference focussed upon the invited energy speakers, but all invited papers were well received, and no one paper in particular received special enthusiasm from the participants.

Energy

A great emphasis was placed upon nuclear energy sources by the three invited speakers in the energy area. Some speakers used talks in inorganic chemistry to bring the relation of innovative chemistry and energy conservation into focus. Little attention was paid to fossil fuels, solar energy, geothermal energy, or other alternatives.

The program commenced Sunday evening with **M. J. Lubin's** presentation (*1,* JLS) on fusion. Beginning with a summary of the concepts of fusion, he quickly reviewed progress and came to the current status of fusion as a potential commercial power source. The "pellet" technology wherein a tiny, carefully engineered pellet of fuel is heated rapidly using lasers was described. The special requirements to be met before this approach becomes viable were set forth. Early decisions frequently lock development into unique channels, and Lubin cautioned that it was too soon to limit developmental options at this time. In response to one question, he indicated that a burst of additional funding in this area likely would not be especially fruitful.

G. T. Seaborg (*2,* JLS) reviewed systematically the magnitude of the energy problem, and he enumerated specific mechanisms for dealing with the problem. Conservation alone will not suffice. Fossil reserves in coal and shale must be exploited. Solar energy can be expected to play an important if limited role, especially in areas such as space heating. Seaborg reviewed the nuclear options, both fission and fusion, and indicated a need to pursue conventional nuclear reactors. Finally, he speculated that hydrogen produced from solar energy may one day make an important contribution to our energy needs.

H. A. Bethe (*93,* JLS) reiterated many thoughts expressed by Seaborg but spent much time on the nuclear energy area. He reviewed issues regarding reactor safety and the need for special training programs. He argued that nuclear wastes could be disposed of safely. His analysis included a discussion of relative risks of nuclear versus conventional fuels, especially health and environmental risks.

During the question and answer period after Dr. Bethe's presentation, Dr. B. Sen of Louisiana State University rose and requested the opportunity to make a statement of several minutes length. Dr. Lubin, the session chair, denied this request, whereupon significant amounts of applause arose from the audience and Dr. Sen left the auditorium in protest. A compromise between Sen and conference organizers was worked out that night (Tuesday), and Sen addressed a group of participants during a special session on Wednesday afternoon.

Chemical educators are a conservative group, and our organized meetings have avoided intense debate over current issues. The procedural issue raised here concerned achieving a balance between the respect we feel to be due to an eminent scientist against the opportunity for a simultaneous public airing of points of view contrary to those s/he expresses. In this case, both the Bethe and Sen presentations were standard fare meriting only the courtesy which chemists normally extend to speakers. The incident raised a great deal of excitement and discussion regarding rights of speech at a conference; the "pro/anti nuke" content-based issues were simply not very intensely discussed by participants in spite of the incident.

R. C. Anderson (*29,* LSF) dealt with practical issues related to the teaching of energy issues to the broadest conceivable audience including average citizens as well as scientists and engineers. The need for clarification of energy concepts versus those of economics, ecology, and ethics was highlighted. Problems with an overabundance of often misleading units were noted. Specification of the initial and final states of all starting materials and products is important. The expression of these notions in terms readily understood by laymen is a key problem.

A. Breyer (*100,* TET) described the use of thermodynamic data and ΔH diagrams for reactions and for thermodynamically definable "steps." Although presentations in terms of ΔG and ΔS were included, the author feels that ΔH diagrams are more instructive for our relatively low temperature world.

Bibliography

(1) **Fusion—An Energy Technology for Tomorrow.** M.J. Lubin, Laboratory for Laser Energetics, University of Rochester, 250 East River Road, Rochester, New York 14623.

(2) **Our Energy Problem.** Glenn T. Seaborg, Lawrence Berkeley Laboratory, University of California-Berkeley, Berkeley, California, U.S.A.

(93) **The Energy Problem and Nuclear Power.** Hans A. Bethe, Newman Laboratory for Nuclear Studies, Cornell University, Ithaca, New York 14853.

(29) **Energy—Understanding and Evaluating Resources.** Robbin C. Anderson, Chemistry Bldg. 100A, University of Arkansas, Fayetteville, Arkansas 72701.

(100) **A Graphical Thermodynamic Approach to Understanding Physiochemical Changes.** Arthur Breyer, Beaver College, Glenside, Pennsylvania 19038

Recombinant DNA

Genetic engineering is reported in the contemporary current events sources from *Newsweek* to the local newspaper. Reading *The Wall Street Journal* gives us ideas about which stocks offer a "play" in recombinant DNA application; reading the scientific literature gives us complex technical descriptions of procedures. A basic technical description of recombinant DNA techniques, one oriented toward chemists, was in order.

G. Wilson (*108,* CEO) proclaimed that we are at the "doorstep of the genetic age" as he began to describe recombinant DNA technology in his amusingly illustrated presentation. A series of discoveries including: plasmids carrying foreign DNA into a bacterial cell; restriction enzymes which recognize certain nucleotide sequences on DNA and cut at these places; techniques for preparing DNA fragments; and insertion enzymes which can help insert new DNA into plasmids. His audience remained skeptical when Wilson suggested that these techniques could soon be used in high school experiments. He summarized the potential benefits of this work. These include: insights into gene function; synthesis of important natural products such as insulin and interferon; and possibly gene therapy. Wilson minimized the risks in this work, one of which is the development of lethal bacterial strains. In addition to physical containment, biological containment involves the use of bacteria which are unable to survive outside of very specialized growth media.

Bibliography

(108) **Recombinant DNA.** Gary Wilson, Medical Center, University of Rochester, Rochester, New York 14627.

Public Understanding of Science

W. E. Burrows (*127,* DWB) gave a delightful talk on press reporting of science. When reporters convey at face value that which is provided to them by corporations, government agencies, testing laboratories, "supposedly disinterested academicians," etc., their stories are often contradictory and confusing. Interpreting science news leaves reporters open to a range of charges. The problems were amusingly set forth in a satirical description of the fictitious MESSUP controversy. Burrows advocated improved science training for those who would become journalists. In particular, he described a creative and unusual program for science training of reporters which is being considered at NYU.

Bibliography

(127) **The Monopolyethylsodiumbichlorinatedsyrupus (MESSUP) Controversy: Press Coverage and Public Perception of Chemistry.** William E. Burrows, New York University, New York 10003.

Health and Safety

In spite of the hue and cry of the public and the often talked about threat of OSHA involvement in academic laboratories, Conference participants did not appear to be preoccupied with health and safety issues. Nevertheless, the Conference organizers provided an excellent presentation on toxicology.

F. L. Scott (*95,* DWB) reviewed basic notions of toxicology, and talked about proposed mechanisms of carcinogenesis. Two mechanisms for carcinogenesis are a "single deleterious event which remains veiled" and a threshold mechanism in which repairs are possible until a threshold is exceeded. Scott observed that some enzyme systems detoxify materials but occasionally produce reactive intermediates which may damage genetic material. His presentation was very smoothly delivered and was an excellent scientific updating. In response to a question about thresholds, Scott cited the example of Tylenol®: there is complete safety below a threshold, but once the glutathione pool of an individual is depleted, serious toxic effects may result to that individual.

A. M. Tometsko (*96,* DWB) compared and contrasted the definitions of mutagenicity and carcinogenicity. He described the Ames test for mutagenicity and reported some interesting results. Some chemicals are found to be antimutagenic: they lower the mutagenicity of other chemicals in the Ames test. He speculated that, for workers that are routinely exposed to mutagenic chemicals, it may be possible to raise the threshold for neoplasm formation by treatment with appropriate antimutagens.

M. C. Nagel (*31,* DWB) gave an exceptionally thoughtful presentation on safety in the high school laboratory. Among the many practical suggestions were to put out only chemicals to be used and in appropriate amounts; to use different sized and shaped bottles, with differently colored caps for different substances; and to pay special attention to chemical storage. She urged that stopping points be built into each experiment, and that these be arrived at as the result of the teacher asking the question, "What would happen if the fire alarm rang now?"

T. J. Tipton (*50,* LLJ) presented the new safety module of Project TEACH, the highly popular materials for training teaching assistants. This module consists of a videotape, written materials, slides, a book, and several pamphlets. Because of its content, the videotape has a wider applicability than TA training and could be used to teach safety to employees in industry as well as to undergraduates.

M. Kolz (*111,* GPB) also described the development of a safety program for TAs, upper level chemistry majors, and high school teachers. A sample videotape program on the use of fire extinguishers was shown. She discussed the strategies of preparing effective modules.

R. Bayer (*114,* GPB) discussed the problems associated with bringing academic laboratories into compliance with federal safety regulations. He described measurements of the concentration of toxic vapors at various points and under various conditions in a typical laboratory. Once such conditions are evaluated for a particular laboratory, both planning for experiments and for facilities improvements can take place in a rational manner.

Bibliography

(95) **Mechanisms in Toxicology.** Francis L. Scott, Department of Chemistry, Rochester Institute of Technology, Rochester, New York 14623.

(96) **Investigating Chemical Toxicity.** Andrew M. Tometsko, Litron Laboratories, 1351 Mount Hope Avenue, Rochester, New York.

(31) **Seminar on Safety in High School Chemistry.** Miriam C. Nagel, Avon High School, Avon, Connecticut 06001.

(50) **Project TEACH Safety Module.** Thomas J. Tipton and David W. Brooks, editors, 227 Hamilton Hall, University of Nebraska-Lincoln, Lincoln, Nebraska 68588.

(111) **Development of a Chemical Laboratory Safety Course as Part of the Curriculum—Employment of Resources.** Marlene Kolz and L. Jewel Nicholls, University of Illinois at Chicago Circle, Department of Chemistry, Box 4348, Chicago, Illinois 60680.

(114) **Evaluating Chemical Atmospheres in Science Laboratories.** Richard Bayer, Chemistry Department, Carroll College, Waukesha, Wisconsin 53186.

Inorganic Chemistry

Homogeneous catalysis, systems for the photochemical conversion of water into hydrogen using visible light, and systems for nitrogen fixation are highly regarded as basic research areas through which relief from the current energy shortage may eventually be achieved. Nevertheless, the excellent inorganic talks did not capture unusual interest from participants.

R. Eisenberg (*3*, NEG) focussed upon common threads between organometallic chemistry and homogeneous catalysis. Several examples were given in terms of catalyst requirements, individual reaction steps, and organometallic intermediates. The substeps in a catalytic cycle include substrate binding and activation, substrate coupling and/or transformation, product elimination, and catalyst regeneration. Each substep was examined in some detail. He gave several examples of successful industrial processes based upon homogeneous catalysis. The talk concluded with an enumeration of potential systems that would help to deal with existing energy problems.

S. Kirschner (*4*, NEG) reviewed recent developments in coordination chemistry. Complexes described included: metal-metal single and multiple bond complexes; multidecker sandwiches; five coordinate nickel(II); fluxional molecules; dinitrogen complexes; cryptate complexes; ferrous capped porphyrins; and picket fence porphyrins. He concluded with comments on platinum complexes with ligands showing carcinostatic activity.

D. Kolb (*27*, EK) dealt with industrial catalysts as she would have classroom teachers describe them to students. Catalysts may make a reaction accessible or may determine the products of a reaction due to selective enhancement among competing reactions. A list of catalysts was provided.

R. W. Collins (*99*, TET) reported the results of a questionnaire assessing the manner in which the descriptive inorganic chemistry core material was being handled. One-third of the responses indicated that this is covered in general chemistry. Others include this material as part of an advanced inorganic chemistry course. Implications of these results were discussed.

Bibliography

(3) **Organometallic Chemistry and Catalysis: Glimpses of the Past, Present and Future.** Richard Eisenberg, Department of Chemistry, University of Rochester, Rochester, New York 14627.

(4) **Some Recent Developments in Coordination Chemistry.** Stanley Kirschner, Department of Chemistry, Wayne State University, Detroit, Michigan 48202.

(27) **Industrial Catalysts.** Doris Kolb, Illinois Central College, East Peoria, Illinois 61635.

(99) **Teaching Descriptive Inorganic Chemistry—How, When, and Why.** Ronald W. Collins, Department of Chemistry, Eastern Michigan University, Ypsilanti, Michigan 48197.

Environment

L. T. Pryde (*28*, LSF) described trends in the incorporation of environmental topics within general chemistry textbooks. Instructors today have a broad range of options to select texts dealing with environmental issues. Pryde sees the inclusion of these topics as an effective method to make the process of communicating chemistry more meaningful for the students.

D. MacInnes (*42*, LLJ) described a field trip during which students studied the ecology of the many habitats visited and performed a number of chemical analyses on the water in each region. Tests included: pH, salinity, turbidity, dioxygen, phosphate, nitrate, and ammonia. A comparison allowed the students to see the effects of urbanization upon the animal and plant communities.

S. E. Wenger (*68*, JIG) introduces his high school students to practical applications of chemistry. His students have been performing freshwater studies of the Chickies Creek Watershed which include optical, electrical, titrimetric, electrochemical, and gravimetric procedures. After ten years these studies have yielded comprehensive results regarding water quality.

H. Bassow (*125*, JIG) discussed the chronological development of the atmospheric ozone depletion controversy. He distributed a handout which included articles from a collection of magazines, newspapers, and congressional hearings. These resources developed the controversy from 1930 when fluorocarbons were introduced through to the present. He described how the topic could be used to interest nonscience students.

Bibliography

(28) **Evolution of Incorporating Environmental Topics into General Chemistry Textbooks during the 1970's.** Lucy T. Pryde, Department of Chemistry, Southwestern College, Chula Vista, California 92010.

(42) **A Five-Week Field Trip—Taking the Lab to the Environment.** David MacInnes, Jr., Chemistry Department, Guilford College, Greensboro, North Carolina 27410.

(68) **Analytical Chemistry—Special Application to Surface and Ground Water Studies.** Samuel E. Wenger, Chemistry Teacher, Manheim Central High School, Manheim, Pennsylvania 17545.

(125) **Will it Live? An Example of the Relevance of Chemical Research for the Nonscience Student.** Herb Bassow, Germantown Friends School, Philadelphia, Pennsylvania 19144.

Underrepresented Groups in Science

Probably the area of most active informal discussion at the Conference was that of underrepresented groups, particularly women and the handicapped. This was true even though only 10% of the formal papers were in this area.

Much talk was devoted to the reasons why women drop out of PhD programs and to how they can be encouraged to stay in. One notion advanced was that "when a man quits a PhD program with a master's degree it's considered to be a failure, but when a woman does that it's acceptable to call it a decision." By no means did a consensus view emerge regarding women in chemistry programs. "Those women just didn't understand what I was saying," said a well-known Division member to the conference editor. Nor did you they, Dr. X!

Women in Science

N. M. Roscher (*62,* AAR) described an NSF supported program in "Career Facilitation Grants" designed to meet the needs of women scientists who either have been out of the job market or under-utilized on the job. The program developed specifically at the American University emphasizes laboratory skills in four areas (physical, organic, analytical, biochemistry). The author summarized the focus of several programs at other institutions.

A. A. Russell (*61,* AAR) described the differential and much higher attrition rate of women than men chemistry graduate students at UCLA. This result occurs in other "male-dominated" disciplines as well. The transition from the "student" role of the new graduate to the "colleague" role of the new PhD is felt to be more difficult for women than men. While peer support groups help ameliorate the problem, special efforts by faculty to encourage "colleague" status of women graduates is necessary.

D. Davenport (*94,* EK) took care to develop the societal context in which three women scientists of the 18th and 19th centuries lived and worked, and to help his audience appreciate them as people. Madame Lavoisier-Rumford (1758–1836) was described by the use of extensive quotes from the gossips of the day as to her appearance, character, wit, and the unhappy nature of her second marriage. Mrs. Jane Marcet published materials intended to introduce women of the early 19th century to contemporary chemical knowledge and beliefs. These lucidly and elegantly written pieces which she herself finely illustrated did much to popularize science. Though known only through her 1794 book in which she published original chemical experiments, Elizabeth Fulhame used a strongly worded preface to illustrate the problems women faced in being accepted as intellectual beings during that period. Davenport touched briefly on some more recent women scientists, and dedicated his session to Dame Kathleen Lonsdale (1903–71), a crystallographer, who had an early influence in his life.

Bibliography

(62) **Women Chemists: Toward a Continuing Professional Career.** Nina Matheny Roscher, The American University, Washington, D.C. 20016.

(61) **The Attrition of Women in Graduate School.** Arlene A. Russell, The Department of Chemistry, University of California, Los Angeles, Los Angeles, California 90024.

(94) **Early Vindications of the Rights of Women Chemists.** Derek A. Davenport, Purdue University, West Lafayette, Indiana 47907.

Teaching the Handicapped

The conference sensitized participants to the problems of hearing-impaired persons. Our sessions were held at the National Technical Institute for the Deaf. Each plenary session was "interpreted" for the hearing impaired. The interpreters were delightful people whose presence added an extra dimension to the sessions. A special presentation on Wednesday evening gave participants more insight to the art of interpretation. Participants could see many conversations in signed English. Our rooms at the NTID dormitory were equipped with strobe-light fire alarms. The bookstore offered many selections on "signing." Even the interpretation of the start of the Chemathon '80 race was impressive. There was probably as much learned about teaching the handicapped as a result of private conversations between participants and interpreters as through any formal aspects of the program. The interplay between Bassam Shakhashiri and his interpreter at the Tuesday morning demonstration session was especially amusing. And the expression on the interpreter's face Monday evening when she was caught off guard by a hydrogen/oxygen explosion was priceless. Now all attendees know how to sign "boom!"

The formal session on teaching the handicapped was convened by B. E. Cain who provided signing for the deaf as he spoke (CHM). This typified the message conveyed by all presenters, namely, that it is possible to be at ease in teaching handicapped students yet not sacrifice quality in the process. Several recurring themes were always to consult the handicapped individual, and never to take for granted that you know what needs to be done; give students as much independence as possible; and, finally, many technological developments have been in response to specific student needs or demands.

M. R. Redden (*21,* CHM) described resources available from the AAAS Office on Opportunities in Science related to: making national meetings accessible; educating younger handicapped students; and locating people who may be willing to act as resource people.

R. C. Morrison (*22,* CHM) pointed out the inadequacy of having sighted assistants aid blind students in laboratory. He described a microcomputer with voice synthesizer that was developed to maximize the student's independence. The device could be interfaced to instruments such as pH meters, etc., and sound out the instrument signals that would normally be read from panels by sighted students.

M. F. Richardson (*23,* CHM) described an adjustable height wheelchair that allows the handicapped student access to the equipment provided at normal height laboratory bays. The superiority of this approach to that of building lowered lab bays was described.

B. E. Cain (*24,* CHM) made many practical suggestions regarding the teaching of deaf students. Because many students lip read, the mouth of the speaker must be visible. Notetakers should be provided so that the student may continue to lip read. Scripts of films, etc., should be made available where possible. Eye protection is critical for deaf students in laboratory.

Bibliography

(21) **Handicapped Scientists.** Martha Ross Redden, Department of Chemistry, Saint Peter's College, Jersey City, New Jersey 07306.

(22) **A Talking Microcomputer System for Aiding Blind Students in Undergraduate Chemistry Laboratories.** David Lunney, Robert C. Morrison, Margaret M. Cetera, Richard V. Hartness, Garfield Locklair, David Sowell, Dept. of Chemistry, East Carolina University, Greenville, North Carolina 27834.

(23) **An Adjustable Height Wheelchair.** Mary F. Richardson, Walt Balenovich, Meinhart Benkel, Tony Biernacki, Ian Brindle, Jack M. Miller, Chemistry Department, Brock University, St. Catharines, Ontario, Canada L2S 3A1

(24) **Teaching Chemistry to the Hearing Impaired.** B. Edward Cain, National Technical Institute for the Deaf, Rochester Institute of Technology, Rochester, New York 14623.

Minorities

J. W. Carmichael (*56,* AAR) described a special multifaceted program aimed at maintaining academic standards as course exit criteria but with attention to raising student performances. Program elements include: a math/science rally to promote science careers among minority high school students; a math/science olympiad to encourage academic achievement among high school students; SOAR, a special summer program designed to enhance problem-solving skills of prefreshmen science majors; integration of "sympathy" into regular science courses; a Piagetian-based laboratory sequence

in general chemistry; and continued emphasis upon close contact and support.

E. Kean (*57,* AAR) described a rationale for establishing academic assistance programs such as the one at Wisconsin-Madison. Changes in the "acceptable failure rate" can involve course content, standards, or tutorial programs. The first two criteria will change if a large fraction of a course population fails. If an identifiable subset of the population fails, tutorial programs are likely to be employed. Such programs are "sometimes useful, sometimes necessary, but never should be considered ends in themselves."

C. Middlecamp (*58,* AAR, LLJ) dispelled some myths surrounding tutorial programs: that one can run them during spare time; that a chemistry PhD is sufficient training; that one will be teaching chemistry as opposed to other more basic skills; and that one needs to start from scratch. At Madison, 120 students/semester are served by a staff of 5. Emphasis is placed upon an analysis of each student's difficulties, and programs are designed accordingly. In addition to individual help, students meet twice per week with a tutor and attend a 2-hour problem-solving session.

J. Bauer (*59,* AAR) described modifications within courses to assist educationally disadvantaged students. At Xavier University of Louisiana these include: weekly sessions which include emphasis upon how to solve problems; condensed lecture tapes; review of math for credit; special efforts to minimize procrastination; required use of molecular models; systematic teaching of study skills; emphasis on building self-confidence; repeatable final examinations; a peer tutoring system; and a coordinated Piagetian-oriented general chemistry laboratory.

Bibliography

(56) **Standards with Sympathy: A Call for Action.** J. W. Carmichael, Jr., Xavier University of Louisiana, New Orleans, Louisiana 70125.

(57) **Special Programs for Special Students: When are They Needed?** Elizabeth Kean and Catherine Middlecamp, Chemistry Tutorial Program, University of Wisconsin-Madison, Madison, Wisconsin 53706.

(58) **Special Programs for Special Students: Factors to Consider in Designing Programs.** Catherine Middlecamp and Elizabeth Kean, Chemistry Tutorial Program, University of Wisconsin-Madison, Madison, Wisconsin 53706.

(59) **General Chemistry for the Educationally-Disadvantaged.** Sr. Joanne Bauer, Barbara Wells, and J. W. Carmichael, Jr., Chemistry Department, Xavier University of Louisiana, New Orleans, Louisiana 70125.

"Doing Chemistry"

Chemistry is an active subject: teachers and students do chemistry in many ways. The lecture demonstration (lecture experiment) is a means for the teacher to involve students with chemistry in an exciting and creative fashion, one well recognized by conference organizers who arranged for five such presentations. As in all preceding conferences, many new student experiments were reported by participants.

Demonstrations

The only lengthy period with no alternative programming during the conference was on Tuesday morning when demonstrations were presented. Indeed, the best received presentation of the conference was undoubtedly that of the Henry Bents, father and son. Bent-the-elder received a well deserved standing ovation at the conclusion of his presentation in what was clearly the most enthusiastic display on the part of participants during the entire conference.

J. A. Schwarcz and **A. E. Fenster** (*52,* LGW) collaborated in the presentation of a show which combined attractive slides, stage magic, and chemical demonstrations. The Monday evening show provided much information at the same time that it delighted children of all ages. Several children were asked to participate. The interpreter for this presentation was a good sport—she conveyed genuine incredulity when surprised by a hydrogen/oxygen explosion. Her presence further enhanced this excellent presentation.

H. A. Bent and **H. E. Bent** (*53,* MJP) extolled the virtues of demonstrations and lecture experiments in classroom teaching. Bent-the-younger did so with a rapid series of catchy phrases on the philosophy of the exercise, many of which were in a point/counterpoint format. Bent-the-elder traced this theme by examining the practices of several of his great teachers and analyzing, through anecdotes, the reasons for their success. He quoted Joel Hildebrand as saying that the purpose of the lecture demonstration was "not to show off but to stimulate the students to think." His finale was an extremely impressive demonstration of burning hydrogen gas at the tip of a long exit tube atop a bell jar (with an open bottom), the result of which was an explosion filling the jar with flames. The jar proved to be cracked, and there was much discussion as to whether the crack was preexisting or was brought about by the explosion.

D. N. Harpp (*54,* MJP) gave an impressive talk on symmetry, during which he demonstrated the power of the lap dissolve slide projection technique that he has made famous in chemistry. He developed several examples of symmetric and near-symmetric relationships in nature. The lap-dissolve technique was at once entertaining and informative; the superpositioning technique illustrates symmetry relationships more clearly than does that of side-by-side projections.

B. Z. Shakhashiri began with the stage literally covered with demonstration materials (*55,* MJP). As he talked, **G. Direen** moved quietly in the background either setting up the next experiment or striking down the preceding one. His theme was the same as that of Bent and Bent. Specific techniques that he recommended included: involving the students in making observations; always be prepared at some point to provide a valid explanation; practice in advance; and be certain that effects are visible by having suitably sized equipment, proper lighting, and appropriate background. His thermite reaction did not work; his reversing air-oxidation of hot copper/hydrogen reduction of hot copper(II) oxide was very impressive. A complete package of write-ups on each demonstration was provided at nominal cost.

A meeting in Rochester would have been incomplete without **J. E. Patton's** conference finale presentation on color photography (*128,* DWB). Patton used three projectors with superimposed images and an overhead projector to demonstrate the principles of additive and subtractive primary colors. The manufacture of thin evenly-coated films is a forte of the Kodak company, and the use of multiple-layered photographic films to produce colored negatives and positives was described in terms of the physical principles. [See *Chemtech,* **9,** 25 (1979) for details.] Instant color photographs are currently produced by Kodak® instant print film by a process in which dye "releasers" are incorporated in the film. Diffusible dyes end up being released in inverse proportion to exposure. Other commercial processes were described. Patton distributed scores of sets of three colored films (yellow, magenta, and cyan) which, when superimposed, gave a full color picture.

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(52) **The Magic of Chemistry.** J. A. Schwarcz and A. E. Fenster, Dawson College, LaFontaine Campus, 1001 Sherbrooke St. E., Montreal, Quebec, Canada H2L 1L3.

(53) **What Do I Remember? The Role of Lecture-Experiments.** Henry A. Bent, North Carolina State University, Raleigh, North Carolina 27650, and Henry E. Bent, University of Missouri, Columbia, Missouri 65201.

(54) **Aspects of Symmetry.** David N. Harpp, Department of Chemistry, McGill University, Montreal, PQ, Canada H3A 2K6.

(55) **New Ideas and Exhortations for Using Demonstrations in Teaching Chemistry.** Bassam Z. Shakhashiri and Glen E. Dirreen, Department of Chemistry, University of Wisconsin-Madison, Madison, Wisconsin 53706.

(128) **The Inside Story of Color Photography.** James E. Patton, Eastman Kodak Company Research Laboratories, Bldg. 82, Kodak Park, Rochester, New York 14650.

Student Experiments

Chemical educators are always in search of new student experiments, and the participants at this conference were not exceptions. Several threads seemed to appear. Experiments involving the use of computers were in evidence. Also, there were several which claimed to have strategies based upon applications of the developmental notions of Jean Piaget. Finally, there were several devoted to specific instruments. No sweeping trends likely to change dramatically the complexion of contemporary student laboratories were apparent.

D. K. Balasubramanian (*130,* GPB) described polyethylene glycol as a substitute for crown ethers in certain situations. Low cost and reduced toxicity are the primary advantages. Experiments included solvent extraction, conductometry, and phase transfer catalysis.

H. M. Bell (*37,* LLJ) described the use of interactive computers in support of the physical methods laboratory. In one experiment, for example, the dipole moment of an organic compound is measured experimentally. The student then predicts the most stable conformation and inputs its coordinates to the computer. A picture of the conformation is returned along with its calculated dipole moment. This process is iterated until a good fit is obtained.

J. S. Copes, (*38,* LLJ) described experiments which provide students the opportunity to explore chemical phenomena through guided inquiry. The emphasis throughout is "observation, ideas, and then formulas." Experiments are selected to emphasize concrete experiences.

J. E. Eilers and **B. D. Joshi** (*39,* LLJ) provided examples of simulated "quantum" experiments. Interactive Fortran programs allow students to see the effect of varying parameters upon electron density plots, harmonics, etc. This concretization of otherwise abstract concepts is thought to help students acquire the concepts more readily.

E. Kelly (*41,* LLJ) spoke to the often neglected issue of data analysis in the physical chemistry laboratory. A commercially available module on statistical analysis (UMAP, 55 Chapel St., Newton, MA 02160) is distributed to students. One outcome of this approach has been an increased emphasis on the part of students on the quality of the data they collect.

T. L. Miller (*43,* LLJ) described a project involving the synthesis of benzoic acid (or a substituted derivative). A wide range of measurements are made, followed by the synthesis and analysis of a copper benzoate salt. All areas of chemistry are employed. The experience is conceptually graduated with detailed instructions provided early in the course but with decreasing detail throughout, ending with students directed to the library for literature studies.

L. Peck (*45,* LLJ) described the mainstream chemistry laboratory program at Texas A&M where the emphasis is on enjoyment and motivation along with laboratory skills. The course is highly structured with its own laboratory manual, quizzes, and prelaboratory videotapes. Microfiche copies of sample laboratories and other information are made available at a student learning center.

D. H. Smith (*48,* LLJ) reported on a successful Dreyfus Foundation/NSF-supported instrument sharing plan operating among four Nebraska colleges. Experiments at a particular school are scheduled according to instrument availability. The consortium has given these schools access to four times as many instruments as each could afford outright, and this is well worth the inconvenience associated with moving the instruments.

D. Teegarden (*49,* LLJ) described a synthesis of butylated hydroxytoluene. The synthesis, which utilizes isobutylene and thereby provides gas handling experience, takes one laboratory period and requires one or two additional sessions for product purification and characterization.

E. G. Bartick (*132,* DWB) conducted workshop sessions on infrared spectroscopy. Emphasis was placed upon the use of Perkin–Elmer's interactive "intelligent" terminals for data handling and interpretation.

C. O. Huber (*70,* WH) described the bromination of nitrophenols as an excellent system for a kinetic study in the undergraduate laboratory. The authors described a simple cell and equally simple electronic circuit which permits one to follow amperometrically the progress of the reaction by measuring the concentration of bromine remaining in the reaction mixture as a function of time. Extensions such as acid/base effects and substituent effects are easily made.

E. Henderson (*84,* CL) described a pocket-sized atomizer for use in flame test applications in the high school laboratory. It is quick and easy, superior to conventional Nichrome wires.

G. Sparrow (*92,* LGW) has designed a dual range conductivity meter which is useful in making qualitative comparisons between solutions. Workshop participants were provided parts and each constructed a meter by the end of the session. Most plan to use their meters in classroom demonstrations of strong, weak, and nonelectrolytes.

G. G. Hickling (*110,* CL) described a multiple choice questionnaire intended as a student self-assessment of laboratory skills. The resulting information helped the faculty focus upon areas of particular student strength and weakness. The laboratory course places considerable emphasis on a laboratory practical test where students "are forced to use their skills to tackle novel problems."

H. T. McKone (*113,* GPB) described the inclusion of HPLC in the second semester undergraduate laboratory as a "real tool used in modern-day chemistry." Separations of components of allspice, cloves, and cinnamon were described.

M. M. Caso (*134,* DR) described the use of a modified differential scanning calorimeter as a tool to study physical and chemical changes which are accompanied by a gain or loss of heat and occur as the temperature of the material is changed. Student experiments include determining the specific heats for bismuth, lead, or 8-hydroxyquinoline.

Bibliography

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(37) **Interactive Computing in the Physical Methods Laboratory.** Harold M. Bell, Department of Chemistry, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061.

(38) **Hands-On Laboratory Experiments for Preparatory Chemistry.** Jane Snell Copes, Department of Chemistry, Hamline University, St. Paul, Minnesota 55104.

(39) **The Quantum Chemistry "Experiment" System.** James E. Eilers, S.U.N.Y. Brockport, New York 14420 and Bhisrav D. Joshi, S.U.N.Y. Geneseo, New York 14454.

(41) **An Increased Emphasis on Data Analysis in the Physical Chemistry Laboratory.** Dr. Edward Kelly, Chemistry Dept., Marian College, 3200 Cold Spring Rd., Indianapolis, Indiana 46222.

(43) **A Project Laboratory Program for First Year Students.** Theodore L. Miller, Department of Chemistry, Ohio Wesleyan University, Delaware, Ohio 43015.

(45) **A Multisection General Chemistry Laboratory Course for All Majors.** Larry Peck, Chemistry, Texas A&M University, College Station, Texas 77843.

(48) **Nebraska Instrument Sharing Consortium.** David H. Smith, Doane College, Crete, Nebraska 68333.

(49) **The Synthesis of BHT: An Experiment in Organic Chemistry with an Industrial Perspective.** David Teegarden and Theresa Varco, Department of Chemistry, St. John Fisher College, Rochester, New York 14618.

(132) **Computerized Infrared Spectroscopy.** E. G. Bartick, Perkin-Elmer Corporation, Rt. 7, Norwalk, Connecticut 06850.

(70) **Amperometric Determination of Phenol Bromination Kinetics.** R. Cohen, C. Matzek, S. Schlosser, and C. O. Huber, Department of Chemistry, University of Wisconsin-Milwaukee, Milwaukee, Wisconsin 53201.

(84) **Use of a Pocket Atomizer for the Emission Flame Test.** Br. Eric Henderson, Bishop Walsh High School, Bishop Walsh Drive, Cumberland, Maryland 21502.

(92) **Portable Conductivity Meter.** Graham Sparrow, Centennial College of Applied Arts and Technology, Scarborough, Ontario.

(110) **Laboratory Skills Evaluation.** George G. Hickling, Department of Chemistry, University of Manitoba, Winnipeg, Manitoba R3T 2N2.

(113) **Introduction of HPLC Into the Undergraduate Chemistry Laboratory.** Harold T. McKone, St. Joseph College, West Hartford, Connecticut 06117.

(134) **Thermal Analysis: An Experiment in Differential Scanning Calorimetry.** Marguerite M. Caso, S. C., and Owen B. Mathre, Department of Chemistry, Saint Joseph's University, Philadelphia, Pennsylvania 19131.

High School Chemistry

If one undercurrent ran through the entire conference, it was related to the high school/college interface. A close cooperation between such formal organizations as the *JOURNAL OF CHEMICAL EDUCATION, SciQuest, Chem 13 News,* and the ACS Office of Educational Activities was apparent. What was more striking was the amount of discussion of activity, ranging from high school teacher workshops to activities at national and regional meetings. Many high school teachers attended the meeting, and much programming came from them. The interest in this activity appears to be both deep and genuine.

When arranging individual reports into groups, the conference editor gave serious consideration to doing away with a separate high school section and placing these reports into other categories. Indeed, a few papers have been treated that way. However, by such an action that spirit of the conference in which so much formal and informal discussion was given to the secondary/tertiary interface would be lost.

J. P. Rouse, whose paper was read by T. E. Taylor (*13,* RGS), reported on his attempts to determine a set of basic objectives which should be expected of every student completing a high school level chemistry course. A questionnaire was sent to several hundred high school and college chemistry teachers. Almost all respondents expected all of the objectives set forth in the questionnaire to be covered! About 20 objectives that should be stressed, those involving problem solving and the relationship of chemistry to the modern world, were identified.

G. P. Baruch (*17,* RGS) reported on six years of research utilizing Piagetian strategies to teach both high school and college chemistry. His strategies include: carefully constructed lecture notes; carefully constructed laboratory data sheets; the nine bottle experiment; and a mnemonic called the logic box. Three years are covered in this high school program.

E. L. Schultz (*89,* CL) stated four high school objectives, namely to: develop an understanding of the scientific method; foster interest in a science career; develop a scientific literacy with decision-making skills; and aquaint students with modern technology. She described an analytical chemistry course, one of three different advanced chemistry courses available to Marblehead High School students. Qualitative analysis is done for the first half of the semester, with an open-access laboratory. The second half of the semester deals with instrumental analysis, with both the nature and schedule of experiments determined on an individual basis. Because a substantial amount of instrumentation is available, this program may not be widely transferable.

A. M. Sarquis (*106,* JH, RF) gave an enthusiastic presentation on the expansion of the Secondary School Section in the JOURNAL OF CHEMICAL EDUCATION. The JOURNAL "needs your contribution;" make the JOURNAL an open letter." Contribute manuscripts either as unattached articles or general features. Become a reviewer! She described a number of high school features currently appearing in the JOURNAL. She went on (*107*) to explain how to prepare a paper for national publication. Know the journal for which you are writing. Call or write to the editor when you feel the need for information. Present the manuscript to the editor in accordance with the style guide published by that journal. Be aware of page and length limits; footnote formats; guidelines for illustrations, graphics, and photos. Know the editorial process, especially with regard to the review procedure. Don't hesitate

to call or write when a long time elapses after submitting your article. Finally, be certain to read and carefully correct all galley proofs.

D. R. Weill, III (*109,* GPB) described a research-oriented organic chemistry laboratory program for high-ability secondary school students as a second year of chemistry. It is subdivided into three sections: 20 weeks on separation science; an intern project where students work in nearby industry; and a library research project. The details of several aspects of the program were presented. Mr. Weill cautioned that his students in this course were of unusually high ability, and that much of his instrumentation was donated by nearby industry.

R. P. Steiner (*115,* ELS) described a program of cooperation between the University of Utah and surrounding high schools. Twenty high school teachers were present for a day of study of the principles and applications of lasers. Activities included lectures by experts and tours of laboratories where hands-on experience with small lasers was possible. Some equipment was purchased and is made available in a lending library. Teachers are invited to bring students to the department for demonstrations of the research lasers.

J. E. White (*116,* ELS) described an NSF supported program in which teachers took minicourses during the academic year and a short course during the summer. A subsequent offering without external support included faculty presentations on chromatography, history, polymers, and biochemistry. Teachers prefer minicourses to typical semester or quarter courses and prefer to take one at a time. Other means of communication with teachers are visits to their schools, departmental newsletters, Teacher Institutes, and state organizations.

E. T. Walford (*117,* ELS) compared high school to college chemistry teaching with respect to work load, pressures, and degree of satisfaction. High school teachers are often less subject oriented than are their college peers; many are teaching courses for which they are not qualified. Salaries for equally trained high school and college teachers are comparable. High school teachers have much higher student contact load and fewer opportunities for peer interaction. When asked if he wanted to return to teaching at the college level, Walford promptly replied "No."

C. L. Stanitski (*118,* ELS) described "Chemistry Day," a

one-day program at Randolph-Macon College to support and encourage high school teachers. Teachers and students worked together on preselected laboratory investigations which were designed for use in a high school laboratory noting the constraints of time and equipment that might occur in a typical high school laboratory. Lunch and refreshments were provided. A career film was shown during that afternoon. The sharing of good lab experiences appears to be the best received format for this activity as compared to others tried at earlier times.

J. Tanaka (*119,* ELS) discussed the impact of the ACS core material recommendations at the high school/college interface. A revised outline for high school curricula included: nomenclature; metric system; dimensional analysis; atomic structure; bonding; reactions; stoichiometry; energy, entropy; gas laws; equilibria; solutions; and acid/base chemistry. A question was raised as to whether high school instructors will be able to cope with this curriculum. It remains to be seen as to whether the speaker and his coauthors will be successful in thrashing out the problems of this regional curriculum.

H. Taylor (*120,* ELS) described a one-day workshop for high school and college chemistry teachers which attracted 50 regional teachers. Activities included an information exchange, a textbook "pool," a special events/program bulletin board, and a curriculum materials display and exchange. A conclusion of the group was that high school teachers should teach basics well and with enthusiasm. More applied math should be taught to improve algebra skills. Finally, exchange visits would be very well received. A subcommittee for chemistry teachers as a part of the Cincinnati ACS section is in the works.

D. A. Halsted (*122,* DDS) discussed the use of modules from the *Interdisciplinary Approaches to Chemistry* (IAC) published by Harper and Row. These modules provide descriptive content not found in most other high school curricula. Since many high school chemistry students do not go to college, the development of positive attitudes as achieved through scientific literacy developed in these modules is important.

J. A. Harris (*123,* DDS) described a chemistry and crime-solving unit which she has developed. Topics which she has included are fingerprints, footprints, hair, and blood; soil samples, minerals, paint, fibers; documents; drugs, poisons; and fire, firearms, and explosives. Students solve mysteries by reading files and by examining a "bag of evidence." Activities include using chromatography to decide which pen was used to write a note, deciding whether a stain is blood, and drug identification methods. A guest speaker from the crime lab at the local police department caps off the unit.

M. B. Andersen (*124,* DDS) described two general strategies that a high school teacher has available to help students cope with the formal (abstract) concepts of chemistry. One is to induce principles first with objects of everyday experience. Several examples were provided, such as balancing equations using poker chips or using foil-wrapped packages of equal but unknown numbers of a variety of objects to introduce the mole concept. A second strategy is to provide examples that contradict the previous experiences of students, prodding them into reorganizing their thought patterns about the physical world. A heated substance undergoing a phase change does not experience a temperature increase; cooling a flask filled with very hot water may cause it to boil.

S. A. Ware (*101,* DR) updated the services being offered to secondary school teachers through the American Chemical Society. Only 19% of high school students take chemistry; 50% of students in secondary schools complete their last science course (usually biology) in grade 10. Ware urged national participation on the part of high school chemistry teachers, where only 900 of 23,000 eligible are members. Current activities include: demonstration workshops, summer conferences, a film library, curriculum guidance, lab safety information, continuing education programs, career literature, and classroom speakers.

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(17) **Implications of Piagetian Psychology for the Teaching of High School and First-Year College Chemistry.** Gerard P. Baruch, Lackey High School, Indian Head, Maryland 20640.

(89) **Analytical Chemistry in High School.** Ethel L. Schultz, Marblehead High School, Marblehead, Massachusetts 01945.

(106) **Communication—It's a Two Way Street.** A. M. Sarquis, High School Editor, *Journal of Chemical Education,* Miami University-Middletown, 4200 E. University Blvd., Middletown, Ohio 45042.

(107) **How to Prepare a Paper for National Publication—Sharing Your Ideas.** A. M. Sarquis, High School Editor, *Journal of Chemical Education,* Miami University-Middletown, Middletown, Ohio 45042.

(109) **Operating a Diversified, Research-Oriented Organic Chemistry Laboratory Program for High-Ability, Secondary School Students.** David R. Weill, III, Shady Side Academy, 423 Fox Chapel Road, Pittsburgh, Pennsylvania 15238.

(115) **Increasing Dialogue between the University and High Schools.** Richard P. Steiner, Department of Chemistry, University of Utah, Salt Lake City, Utah 84112.

(116) **Communicating with High School Teachers.** J. Edmund White, Department of Chemistry, Southern Illinois University-Edwardsville, Illinois 62026.

(117) **A Comparison of High School Teaching with College Teaching (by One Who Has Done Both).** Edward T. Walford, Cheyenne Mountain High School, Colorado Springs, Colorado.

(118) **Chemistry Day and the Secondary School/College Interface.** Conrad L. Stanitski, Randolph-Macon College, Ashland, Virginia 23005.

(119) **Will the ACS Core Material Recommendation Affect the High School/College Interface?** Raymond N. Blanchette, Mahlon F. Hayden, Science Dept., E. O. Smith High School, Storrs, Connecticut, and John Tanaka, Chemistry Department, University of Connecticut, Storrs, Connecticut 06268.

(120) **Workshop at the Interface of High School College Chemistry.** Harriet Taylor and Mickey Sarquis, Miami University, 1601 Peck Boulevard, Hamilton, Ohio 45011.

(122) **Teaching Essential Concepts in the 1980–81 High School Chemistry Course.** Douglas A. Halsted, Evanston Township High School, Evanston, Illinois 60204.

(123) **Who Dun' it: A Crime-Solving Unit for Nonscience Students in Chemistry.** Janet A. Harris, Cy Fair High School, Rt. 12, Box 8 B, Houston, Texas 77040.

(124) **Dumb Demos, Ludicrous Labs, and Absurd Analogies.** Margaret B. Andersen, Westfield High School, 177 Montgomery Road, Westfield, Massachusetts 01085.

(101) **Educational Progress through Partnership Programming, the Society and the Schools.** Sylvia A. Ware, Office of High School Chemistry, American Chemical Society, 1155 16th Street, N.W., Washington, D.C. 20036.

Media, Gadgets

At recent conferences (Madison, Fort Collins, and now Rochester) there have been displays of new media and gadgets. If anything, there seemed to be less of this activity at Rochester than there had been previously, especially in the computer area. Presenters tended to bring output rather than to provide hands-on "on line" activity for participants.

Models

S. J. Baum (*7*, DHS) reports the integration of molecular models within his laboratory manual. Students build models of reactants and products as they work through the experiments.

G. O. Larson (*86*, LLJ) presented a demonstration of his 3-D folded paper molecular models. Paper representations have been combined with Minit© frameworks for styrofoam balls. Models with accurate, clearly visible bond angles and internuclear distances are capable of representing the 3-dimensional spatial characteristics of the pi-bond and conjugation.

D. A. Halsted (*51*, LGW) conducted a workshop in the use of space-filling models in the teaching of molecular structure. Each participant was provided with a kit. Examples of using models included: balancing equations; spatial relations in molecular and ionic structures; relations between shape and polarity; and geometric aspects of intermolecular interactions. Workshop participants were shown how to assemble the parts of their kits, and how to build a wide variety of structures.

Bibliography

(7) **The Use of Molecular Models in the Organic/Biochemistry Laboratory.** S. J. Baum, State University of New York, Plattsburgh, New York 12901.

(86) **Hybrid Stereomodels.** G. Olof Larson, Ferris State College, Big Rapids, Michigan 49307.

(51) **Models Workshop: Space-Filling Molecular and Ionic, Atomic and Molecular Orbitals.** Douglas A. Halsted, Evanston Township High School, Evanston, Illinois 60204.

Computers

J. I. Gelder (*40*, LLJ) described CAI programs written for the $2,500 Apple II Plus which incorporate the latest ideas in learning theories to produce an attractive means of introducing the abstract concepts of introductory chemistry. For example, a student learning the gas laws can call up on a color TV screen a picture of a cylinder and piston. S/he can "introduce" a measured number of moles of ideal gas, and then vary the volume and temperature by adjusting controls. The student who has difficulty relating these concrete phenomena to kinetic molecular theory can then ask to see the "molecules" and the cylinder is suddenly filled with bright red blips. A beep tone is heard for each collision, which produces a rising crescendo as the pressure is increased. One "molecule" is colored white so that an individual trajectory can be observed amid the confusion.

K. J. Johnson (*63*, JIG) described three Fortran programs. QUAL is a 13-cation inorganic qual simulation program. ID is a 20-questions game in which the object is to identify the unknown inorganic compound with the minimum number of questions. NINSOL is a variation of the nine bottles experiment. Several other programs are also available. These may be shared at nominal cost by contacting the author.

J. W. Beatty (*64*, JIG) described a program for underprepared students which makes use of nine CAI modules. The course is designed to develop math skills and student confidence using a mastery approach. Considerable success is claimed for increasing student self-confidence. The author advocates the 8K PET microcomputer as economical and especially well suited to providing needed graphics.

J. Hutchinson (*65*, JIG) has written a problem set generating program for DEC 11. The program is designed to produce large numbers of individualized problem sets to be distributed to students. The program also generates answers for the instructor. It is designed to allow the user to enter the text for the problem, the range of numerical values, and the equation necessary to arrive at the correct answer. Copies may be arranged by writing to the author.

G. S. Owen (*66*, JIG) described interfacing an Apple II to a Hitachi UV-Visible spectrophotometer through an 8-bit analog to digital converter (ADC). The ADC will allow up to 16 instruments to be controlled by the Apple II. The Apple is used to collect the spectral data which is down loaded to an IBM 1134 where calculations are performed and returned to the Apple to be plotted using high-resolution graphics. Many details of using the Apple were described by the author who feels that this microcomputer is well suited for interfacing laboratory instrumentation.

C. Allen (*67*, JIG) applied electronic data processing to produce an annotated list of the laboratory experiments published in the JOURNAL OF CHEMICAL EDUCATION. The program will create a file containing the author's name, title, etc., and a series of keywords based on the titles to locate an experiment or set of experiments of particular interest. Requests for details should be directed to the authors.

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(63) **Communicating Descriptive Chemistry with a Computer.** K. Jeffrey Johnson, Department of Chemistry, University of Pittsburgh, Pittsburgh, Pennsylvania 15260.

(64) **Preparation for Chemistry, A Complete Course with Complementary CAI Programs.** James W. Beatty and Earle S. Scott, Chemistry Department, Ripon College, Ripon, Wisconsin 54971.

(65) **A Computer Program for the Facile Construction of Problem Sets Containing Different Numerical Values for Each Student.** James R. Hutchinson, Alma College, Alma, Michigan 48801.

(66) **A Microcomputer-Based Laboratory Data System.** Deborah Travis, Terry Green, G. S. Owen, Department of Chemistry, Atlanta University, Atlanta, Georgia 30314.

(67) **Applications of EDP in Chemistry: (1) Annotated List of Laboratory Experiments from J. CHEM. EDUC. with Computer Access; (2) Computer-Assisted Report Grading; (3) Socrates, An Instructional Technique in Problem Solving.** Carolyn Allen, SUNY Stony Brook, Stony Brook, New York 11794, Stanley Bunce and James Zubrick, Rensselaer Polytechnic Institute, Troy, New York 12181.

Other Media

W. T. Burnett (*9, 82,* DHS, CL) described a television approach to the demonstrations of laboratory skills using hardware obtained through an NSF CAUSE grant. The LSU philosophy of television production was presented.

D. W. Emerson (*10,* DHS) requires that students demonstrate mastery of basic skills outside of the classroom. For example, 12% of 454 students fail at proportions, but 88% fail for significant figures and 92% for graphing. Sharply focused individualized learning on these topics is offered through media such as written texts, slide/tape presentations, videotapes, and hands-on work with instruments. This work is accomplished at a learning resources center.

L. L. Jones (*85,* CL) presented videotaped demonstrations (using the Betamax format) which are employed in general chemistry classes taught by TAs in charge of a particular section, a system used at Illinois-Urbana. The demonstrations are interactive in that the tape may be stopped with responses elicited from the students at appropriate times. The philosophy is that all sections can have access to the demonstration-type experiences.

J. L. Sarquis (*88,* CL) described audiotaped discussions and accompanying workbooks as a supplement to the traditional lecture presentation. These resources appear to be used heavily by students, mostly in their homes. Student participation has been carefully integrated within the taped material.

G. M. Bodner (*97,* TET) used the lap dissolve slide technique to show three-dimensional crystal networks. Packing arrangements, octahedral holes, tetrahedral holes, and unit cell designations are shown. Slide sets may be purchased from the author.

M. Dupre (*131,* GMB) described a method of team teaching between the teacher and a CHEM Study film. He averages two 45-minute lectures to complete one 22-minute film. The stopping points are filled with discussion between Dupre and his students.

S. Feingold (*133,* DWB) described various techniques used to prepare slides for instructional purposes, and to making synchronized slide-tape programs. Much information was provided by his company, Visual Horizons, of Rochester, New York. He responded to a wide range of audience questions.

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(10) **Teaching Basic Skills Needed for Chemistry. Mastery Learning Modules and a Delivery System.** David W. Emerson, Department of Natural Sciences, The University of Michigan-Dearborn, Dearborn, Michigan 48128.

(88) **Instructional Materials for Commuter Students.** Jerry L. Sarquis, Chemistry Department, Miami University-Middletown, Middletown, Ohio 45042.

(97) **The Introduction of Crystal Structure Concepts Using Lap-Dissolve Slide Techniques.** George M. Bodner and William R. Robinson, Department of Chemistry, Purdue University, West Lafayette, Indiana 47907.

(131) **Team-Teaching with Media.** Maurice Dupre, Champlain Regional College, P.O. Box 3080, Lennoxville, Quebec J0B 1Z0 Canada.

(133) **Economy Slide Productions.** Stanley Feingold and Reenie Feingold, Visual Horizons, Rochester, New York.

Faculty Development, TAs, Teaching Strategies

A wide variety of different papers were presented in the "teaching methods" area. However, there was no major sense of movement from the participants toward this direction. Some of these papers stressed content—how to use the subject itself to get an idea across.

G. Crosby (*19,* NEG) used exuberant prose as he reviewed the development of Avogadro's ideas. He went on to present some sample calculations designed to show students the effect of scaling to the mole scale. Avogadro's number was shown to be the bridge between the microscopic and macroscopic worlds. As an illustration of the magnitude of Avogadro's number, Crosby concluded with a few slides of the results of fallout from the Mt. St. Helen's eruption. Small sample vials of volcanic ash were distributed to the audience.

T. M. Dunn (*20,* NEG) proceeded to develop further the theme begun by Crosby. He encouraged his listeners to participate in *gedanken* experiments with a Maxwell's demon and noted that he has asked students to write assays on "My Life as Maxwell's Demon." He concluded with a review of several precise determinations of Avogadro's number and noted that unresolved discrepancies in the value from various measurements remain.

G. Haight (*72,* WH) presented a discussion of oxidation-reduction reactions beginning with the "phlogistonists." If one interprets phlogiston to mean electrons, the present day interpretation of redox processes is entirely consistent with the phlogiston theory. Evidence exists for mechanisms in which not only one, but two, three, and even four electrons are transferred. The products of the oxidation of hydrazine and of sulfite ion (so-called discriminators) allow one to characterize certain oxidizing agents as one-electron transfer agents (monodeelectronators) and others as two-electron transfer agents (di-deelectronators).

J. D. Herron (*102,* JH, RF) provided an enjoyable analogy between science and religion. He compared the need for scientific understanding to the need for knowledge of religious principles and theology. People are led to believe that only a few are capable of understanding science. Herron argued for a kind of scientific literacy achievable by the communication of practical applications rather than theoretical ideas.

E. Vitz (*6,* NEG) used several Sidney Harris cartoons and two demonstrations to introduce an argument for a new definition of chemistry: a study of atoms and molecules and their properties. This definition, he argues, better communicates what it is that chemists do.

M. J. Pavelich (*74,* RGS) discussed the art of asking questions in the lecture class. He illustrated the kinds of cognitive demands which a question can elicit. The questions he used brought out attendee interest because they dealt with college enrollment, salaries, and equipment funds. In a large class he suggests discussion, work-time answer sessions, and homework. In small classes he favors problem sets to be worked in class and small group discussions.

M. C. Hidalgo (*79,* RGS) described techniques for small group discussion in which students must read papers (8–10 pages) and condense their contents into no more than 10 lines and then into a 10-word slogan. She summarized several benefits she felt resulted from this approach.

J. H. Cullen (*32,* JEW, PKW) described a summer training program for new TAs at Cornell. Objectives are orientation

to the department; instruction in effective teaching methods; and experience with different techniques of teaching. Teaching instruction included techniques for leading a discussion, questioning, and classroom discipline. Other activities included discussion of Project TEACH modules, observation in classes, introduction to Piaget, and concept mapping. The program is now being offered in four weeks length, and $\frac{2}{3}$ of the new TAs are expected to participate.

T. R. Wildeman (*73*, RGS) described a seminar program aimed at faculty development in teaching. Three kinds of seminars were employed: an ordinary hour-long session; a new faculty workshop; and a workshop seminar spread out over several weeks. About $\frac{1}{5}$ of the faculty regularly attend. The group has become influential in determining policy related to teaching. To establish such a program, several like-minded faculty are needed together with about $5,000 in funding for speakers and expenses.

T. R. Wildeman (*8*, DHS) also gave a talk based upon the faculty development seminar series at the Colorado School of Mines (*73*). Good lecturers try to create a two-sided communication. Basic techniques were discussed. Other suggestions included: explain your identity (hobbies, research) and know the student's identities (majors, reasons for taking course); show your personality; determine the mood of the students, and respond. When lecturing, a break about once every 15–20 minutes is needed; demonstrations work well here.

T. E. Taylor (*14*, RGS) spoke to the teacher's role as a developer of a creator of knowledge. The teacher is to awaken and channel ideas. Give the students truly new experiences; use more than just one sense. Create dissonance in the students—a will to doubt. During the question period, Taylor maintained that the traditional lecture may be obsolete.

L. S. Fowler (*15*, RGS) opened with a brief summary of Piaget's theory and continued with the demonstration of and discussion of a "learning cycle." Her presentation was illustrated with a learning cycle based upon transferring water between two large containers using unequally sized dippers until equilibrium is reached. Discussion centered upon the development of suitable classroom learning cycles.

L. C. Lewis (*16*, RGS) sees the teacher as a facilitator of learning whose primary function is to expedite cognitive development. He tries to maximize student/instructor contact time during which the instructor responds to student-initiated comments and questions. He described a modular biochemistry program that he developed which supports these techniques. The discussion session following his talk centered around the questioning techniques used by Lewis.

L. G. Williams (*18*, RGS) described a unique approach to teaching found at Hampshire College where the emphasis is upon problem solving and inquiry at the freshman level. Students begin by designing and carrying out a chemistry project, the goal of which is for the student to understand one mode of inquiry used in science. Typical course topics are holography, acid rain, photographic reproduction, and energy and the environment. Students are evaluated by a faculty committee at an oral exam. Although this approach might be expected to produce superior innovative chemistry students, one sobering note brought out during discussion was the 40% attrition rate.

A. T. Schwartz (*25*, EK) recommended that teachers deliberately introduce ambiguities of science to their students. He uses phenomenological and historical approaches to introduce ambiguity. In laboratory, observation of phenomena and attempts at explanation are given primacy over theory. Case studies of past controversies in developing scientific models are used to teach scientific development. Such approaches require time and effort to develop. Students often find it more difficult to begin learning with direct observations rather than with presented facts.

P. K. Welty (*33*, JEW) uses the term "nonfacilitating topics" to describe those topics found in the general chemistry course which either inhibit the learning of broader topics or distract attention from broader topics. To alleviate this problem, one delays those nonfacilitating topics which are necessary and deletes those which are not. Welty argues that the atomic mass unit is a topic to be deleted. He recommends giving weights of atoms in grams and defining the mole according to the mass ratio.

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(19) **All Things Great and Small. I. Avogadro and the Concept of the Mole.** G. A. Crosby, Department of Chemistry, Washington State University, Pullman, WA 99164.

(20) **All Things Great and Small. II. Physical Consequences of Scale.** T. M. Dunn, Department of Chemistry, University of Michigan, Ann Arbor, MI 48109.

(72) **Concepts and Mechanisms for Redox Reactions.** G. P. Haight, University of Illinois, Urbana, IL 61801; Martha Barrett, University of Colorado, Denver, CO 80202; Robert Scott, Stanford University, Stanford, CA 94305.

(102) **Science, Society, and the Reformation.** J. Dudley Herron, Purdue University, West Lafayette, IN 47907.

(6) **The Meaning of Chemistry.** Edward W. Vitz, Michigan State University, East Lansing, MI 48824.

(74) **The Art of Asking Questions in the Lecture Class—An Approach to Enhancing Higher Level Thinking.** M. J. Pavelich, T. W. Wildeman, E. D. Sloan, Colorado School of Mines, Golden, CO 80401.

(79) **Active Teaching Form.** M. Consuelo Hidalgo, Escuela Nacional de Estudios Profesionales Zsragoza, Universidad Nacional Autonoma de Mexico, Mexico, D. F. Mexico.

(32) **A Comprehensive Preservice Teaching Assistant Training Program.** Stanley T. Marcus, Chemistry Department, Cornell University, Ithaca, New York 14853, John H. Cullen, Chemistry Department, SUNY-Cortland, Cortland, NY 13045.

(73) **A Program for Increasing Faculty Awareness of Practices and Theories in Education.** E. D. Sloan, T. R. Wildeman, M. J. Pavelich, Colorado School of Mines, Golden, CO 80401.

(8) **Opinions on the Lecture.** T. R. Wildeman, M. J. Pavelich, and E. D. Sloan, Colorado School of Mines, Golden, CO 80401.

(14) **Teaching to Develop Judgment, Insight, and Imagination.** Thomas E. Taylor, Department of Chemistry, Texas A&M University, College Station, TX 77843.

(15) **The Use of Learning Cycles in Teaching Chemistry.** Linda S. Fowler, 8535 Brent Dr., Cincinnati, OH 45231.

(16) **Facilitating Cognitive Development in an Upper-Class Chemistry Course.** L. C. Lewis, Department of Chemistry, Sioux Falls College, Sioux Falls, SD 57101.

(18) **Chemistry at Hampshire College: An Experimenting Approach.** Lloyd G. Williams, School of Natural Science, Hampshire College, Amherst, MA 01002.

(25) **Admitting Ambiguity.** A. Truman Schwartz, Macalester College, St. Paul, MN 55105.

(33) **Nonfacilitating Topics in General Chemistry.** P. K. Welty, Department of Chemistry, Miami University, Oxford, OH 45056.

New Courses

As one might expect, the conference brought forth many reports of new courses. Most of these involved using new strategies rather than teaching new and/or different content. At other recent times there seemed to be a movement toward the addition or deletion of one or another type of chemistry course. For example, a decade ago we saw a wave of environmental chemistry courses. If such a move were afoot at Rochester, it escaped the notice of the conference reporters.

W. E. Wesolowski (*30,* LSF) described a course, Introduction to Industrial Chemistry. He emphasized the need for incorporating comparisons of textbook chemistry to industrial chemistry in courses. In addition, he talked about the group dynamics of the industrial work situation and how one can use groups and group leaders in teaching laboratory situations.

R. D. Downing (*34,* GMB) described a team taught chemistry and physics course. Students in the class may enroll for chemistry, physics, or both. Topics taken in common are units, problem-solving strategies, graphing, report writing, atomic theory, bonding, states of matter, nuclear science, electrochemistry, and thermodynamics.

G. Rhodes (*75,* RGS) described a freshman seminar. "Science and Literature." A short written paper is an admission ticket to each session, the first hour of which is conducted entirely by students. Rhodes spoke of the difficulties students had in comparing activities in science and literature. The discussion period led to questions that related Rhodes' observations of his students to a scheme of intellectual development attributed to William Perry of Harvard.

U. Zoller (*77,* RGS) discussed his experience in developing three sensitive chemistry curricula: chemistry and smoking; chemistry, hashish, and marijuana; and chemistry and alcoholism. The difficulties in dealing with issue-laden subjects were discussed at length.

C. E. Ophardt (*87,* RGS) feels that students in allied health chemistry courses need knowledge of biochemical principles more than they do a functional group approach to organic chemistry. He has reorganized his course based upon this notion in a program which appears to be as well executed as conceived. Biochemical topics are always tightly coupled to traditional organic topics in his course organization.

D. M. Thompson (*90,* CL) described a January Term offering, "Elementary Scientific Symmetry." The course is an excellent blend of hands-on experiences with symmetry, mathematical introduction to group theory, and an interactive small group learning experience. Symmetry examples from the everyday experience are used extensively. The most striking models employed were some "cut and paste" three-dimensional representations of the work of Escher.

Y. S. Yamamoto (*91,* CL) described the RIT co-op program which has been in operation since 1912. About 80% of the co-op students work in Rochester or the adjacent northeastern part of the country. Some 70 students are currently involved. About 50% of the students accept employment with their co-op employers. This program has clear advantages for the career-oriented student. Even though the program takes longer to complete (3 years for associate degrees; 5 years for bachelors), it seems to be cost effective for the student.

W. F. Coleman (*98,* TET) described an upper division/beginning graduate level course on "Chemical Applications of Lasers." Four major topics include: nature of the lasing process; nature of laser light; survey of available lasers; and selected applications. Course experiments include measurement of wavelength dependence, laser intensity measurements, two photon excited fluorescence, and modular construction of a Raman spectrometer.

I. M. Gottlieb (*104,* JH, RF) emphasized the need for colleges to hybridize their science curricula with nonscience offerings. He noted that many science trained undergraduates move toward law or business degrees rather than to traditional masters and PhDs. The BS level degree in science Administration at Widener University is intended to provide foundations in science as well as for scientific uses in a complex socio-economic environment.

D. I. Lewis (*112,* GPB) described the "Broad-Option Laboratory" for students to learn basic chemical principles and skills while gaining experience in a specific career field. She has used this approach at the introductory 4-year college level for science majors, at the 2-year level for nursing and medical technology students, and an instrumental analysis course at a 4-year university.

M. P. Goodstein (*11,* DHS) suggested that students not doing well in the math parts of a general chemistry course disappear as if they had fallen into a black hole. A Sci-Math project was developed to help students do proportional calculations. It is critical to teach relationships rather than just sample problems.

B. Wells (*60,* AAR) described a Piagetian-based laboratory program which is used in conjunction with a PSI lecture system. Emphasis is upon "exploration through doing" without instructions. Safety procedures and time guidelines are provided. The three-phase learning cycles approach to experiments was discussed. Student alumni of this course perform as well as those of a traditional course on skills tests at the end of the term.

S. Bunce (*12,* DHS) described a chemistry course supplemented for the well-prepared student, wherein two semesters of general chemistry are presented in one semester. Individualized assignments are based upon pretests, and lab work is individualized based upon a student's background. This course is problem-oriented.

Bibliography

(30) **Training Students for Industry—Results of a Regional Survey.** Wayne E. Wesolowski, Illinois Benedictine College, 5700 College Road, Lisle, Illinois 60532.

(34) **Evolution of the Introductory Chemistry/Physics Team-Taught Program at Community College of the Finger Lakes.** Rochelle D. Downing, Frank C. Mooney, and Leslie N. Davis, Community College of the Finger Lakes, Canandaigua, New York 14424.

(75) **Communicating Science: Some Problems with the Language.** Michael McClintick, Engligh Department, and Gale Rhodes, Chemistry Department, Whitman College, Walla Walla, Washington 99362.

(77) **Communicating Chemistry: The Issue of "Sensitive," Interdisciplinary, Chemistry-Oriented Curricula in the Social Service.** Dr. Uri Zoler, the School of Education of the Kibbutz Movement, Oranim P. O. Kiryat Tivon, Israel.

(87) **An Integrated Organic and Biochemistry Allied Health Course.** Charles E. Ophardt, Elmhurst College, Elmhurst, Illinois 60126.

(90) **Overture to the Communication of Crystallography—A January Term Course in Symmetry.** Doris M. Thompson, Department of Chemistry, Austin College, Sherman, Texas 75090.

(91) **Organization and Implementation of a Cooperative Education Program in Chemistry.** Y. Stephen Yamamoto, Rochester Institute of Technology, One Lomb Memorial Drive, College of Science, Rochester, New York 14623.

(98) **Lasers in Chemistry and in the Chemistry Curriculum.** William F. Coleman, Department of Chemistry, University

of New Mexico, Albuquerque, New Mexico 87131.

(104) **Discipline versus Career Oriented Programs in Science: The Dilemma Revisited.** Irvin M. Gottlieb, Widener University, Chester, Pennsylvania 19013.

(112) **The Broad-Option Laboratory: Some Applications.** Doris Ingram Lewis, Suffolk University, Beacon Hill, Boston, Massachusetts 02114.

(11) **Math for Introductory Chemistry is a Black Hole.** Madeline P. Goodstein, Central Connecticut State College, New Britain, Connecticut 06050.

(60) **A Piagetian-Based General Chemistry Laboratory Program for Science Majors.** Barbara Wells, Sr. Joanne Bauer, and J. W. Carmichael, Jr., Chemistry Department, Xavier University of Louisiana, New Orleans, Louisiana 70125.

(12) **Chemistry for the Well-Prepared Student.** Stanley Bunce, Rensselaer Polytechnic Institute, Troy, New York 12181 and Caroline Allen, State University of New York at Stony Brook, Stony Brook, New York 11790.

General Papers

As with any large conference, there were several presentations which defied compartmentalization into categories.

A. B. Johnson (*126*, DR) presented an analysis of studies of 297 pupils in 20 O'Level schools in Sierra Leone, West Africa. She found the Scholastic Aptitude Test (SAT) to be the best predictor of sciences in chemistry and physics for students going on to American and European Universities.

L. F. Hatch (*121*, ELS) described aspects of teaching and student life in Saudi Arabia.

H. G. Friedstein (*105*, JH, RF) has developed a curriculum component, "Career Education as an Integral Part of the Science Classroom." She uses newspaper and magazine ads for professionals, annual reports of companies, and field trips to local industries as resources. She asks students to simulate the development and marketing of a product through the corporate structure.

D. A. Katz (*103*, JH, RF) recommended using historical perspectives as a means of putting descriptive chemistry back into the curriculum. There are opportunities to show how chemistry developed from the arts and trades: metal working and alchemy, dyes and pigments, building materials, glassmaking, perfumes, beer and wine. The talk was highlighted with examples and a demonstration of changing "copper into gold and silver."

S. Gannaway (*83*, CL) detailed a systematic and comprehensive textbook evaluation instrument which includes the Fry readability test. Application requires 6–7 hours per text. The levels of cognitive domain are emphasized and the comparison of formal and concrete requirements are obtained through use of the survey; presentation sequence and difficulty of mathematical content are not.

K. Berry (*80*, CL) presented a comprehensive checklist of textbook qualities to be considered prior to adoption. He concentrated on text readability using several approaches.

W. Bleam, Jr., (*81*, CL) described several useful analogies. The fruit basket analogy is used for stoichiometry, as is the mole-mole bridge. He reports excellent results with students at the concrete operational stage of development.

J. F. Eix (*78*, RGS) presented a novel approach to teaching students about the periodic chart. His method is based upon close examination of the ionization energies of the first 20 elements.

J. D. Hostettler (*69*, WH) used pe-pH diagrams to display the aqueous oxidation reduction chemistry for a variety of substances. The diagrams are constructed using the Nernst equation at various pH's. The resulting graphs delineate regions or fields where the various species are thermodynamically stable. By comparing the curve for water with that for other elements, one can predict the species stable in aqueous solution. These diagrams are an excellent tool for displaying descriptive chemistry.

L. J. Sacks (*47*, LLJ) has postulated a new model for chemical bonding based upon the charge ratio and ionic size ratio. Several assumptions are unusual. Hydrogen is considered as the negative hydride ion in all compounds, and electronegativity is rejected as having no physical meaning.

G. Rhodes (*46*, LLJ) has worked out a method for averaging conformations which demonstrates the concepts of chemical versus magnetic equivalency to the most skeptical student.

M. V. Orna (*44*, LLJ) described the pigment analysis of a recently discovered medieval manuscript as an example of an interdisciplinary project between an analytical chemist and an art historian. The result has been the first complete color palette of a medieval manuscript. Techniques employed included polarized light microscopy, X-ray diffraction, and X-ray fluorescence.

V. A. Wilcox (*35*, GMB) described the teaching of chemistry at a science museum. Demonstrations must compete for a visitor's attention. Various strategies to develop museum materials were described.

K. E. Kolb (*26*, EK) has used the SQUIB concept, brief news items about chemistry, for years. Students are held responsible for the SQUIB material presented. SQUIBS may be generated by either students or faculty. They have the effect of sensitizing students to the place of chemicals and the chemical industry in their lives.

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(126) **Science Achievement, Scholastic Aptitude and Self-Concept as Predictors of Success for the School Certificate General Certificate Examinations in Ordinary Level Chemistry and Physics of Pupils in Sierra Leone, West Africa.** Angela B. Johnson, Ed.D.

(121) **Where the East Meets the West in the Chemistry Classroom—Chemical Education in Saudi Arabia.** Lewis F. Hatch, Dhahran Int'l Airport 144, UPM 79, Dhahran, Saudi Arabia, and Marie S. Hatch, KFU, College of Medicine, Dammam, Saudi Arabia.

(105) **Career Education as an Integral Part of the Science Classroom,** Harriet G. Friedstein, 41 Hilltop Drive, Pittsford, NY 14534.

(103) **Using History to Present Descriptive Chemistry.** David A. Katz, Department of Chemistry, Community College of Philadelphia, 34 South 11th Street, Philadelphia, PA 19107.

(83) **Chemistry Textbook Evaluation.** Susan Gannaway, Nazareth College of Rochester, 4245 East Avenue, Rochester, NY 14610.

(80) **It Really Looks Good, But Why Can't I Understand It?** Keith Berry, Department of Chemistry, University of Puget Sound, Tacoma, WA 98416.

(81) **The Fruit Basket Analogy, the Mole-Mole Bridge, and Other Excursions into the Absurd(ly Useful).** William Bleam, Jr., Radnor H. S., 130 King of Prussia Rd., Radnor, PA 19087.

(78) **A Novel Approach to the Periodic Table.** John F. Eix, Upper Canada College, 1345 Kensington Park Road, Oakville, Ontario L6H 2G8.

(69) **Teaching Descriptive Chemistry with pe-pH Diagrams.** John D. Hostettler, Department of Chemistry, University of Colorado, Austin Bluffs Parkway, Colorado Springs, CO 80907.

(47) **A Unified Model for Chemical Bonding.** Lawrence J. Sacks, Christopher Newport College, 50 Shoe Lane, Newport News, VA 23606.

(46) **Nuclear Equivalence and Conformational Rotation.** James S. Todd and Gale Rhodes, Chemistry Department, Whitman College, Walla Walla, WA 99362.

(44) **Pigment Analysis of the Gladzor Gospel Book of U.C.L.A.** Mary Virginia Orna, O.S.U., College of New Rochelle, New Rochelle, NY 10801.

(35) **Chemistry in a Science Museum.** Valerie A. Wilcox, Museum of Science, Science Park, Boston, MA 02114.

(26) **Keeping Chemistry Courses Relevant, Modern, and Interesting.** Kenneth E. Kolb, Chemistry Department, Bradley University, Peoria, IL 61625.

Other Aspects of the Conference

On Tuesday afternoon, Margaret Anderson chaired a session of participants interested in the high school/first year college interface. The skills which best served the needs of the college bound student, as decided by a sort of consensus, are attitude toward learning; ability to deal with models and abstractions; skills in laboratory manipulations; basic academic and study skills—reading, writing, computation; and learning from inference (self-teaching, self-disciplining, self-motivating).

On Monday afternoon, the University of Rochester held an open house. Buses were provided to the River Campus of the U. of R. As reported by Truman Schwartz, visitors were cordially welcomed to Charles F. Hutchinson Hall, the new home of the chemistry and biology departments by Rochester chemists. The hosts conducted brief tours of the excellent research facilities and summarized some of the problems currently under investigation. There was also opportunity for Chem Ed conferees to visit informally with some of the 24 chemistry professors and 80 graduate students. The conversation was augmented with cheese, crackers, sherry, and French Colombard.

Conference Arrangements

Participants smoothly were checked into a twelve-story dormitory where accommodations were very good. Families were checked into a campus motel. Many of those in the dormitory enjoyed late evening (early morning) hours, accompanied by liquid spirits.

The opening session on Sunday at 8:00 PM was followed by an elegant reception including sherry and petit-fours. Every evening thereafter, there were beer-and-pretzel receptions.

Arrangements at Madison included living and eating in a single dormitory, a very desirable situation. At Fort Collins, dormitories were more spread out and most meals were catch-as-catch-can. This proved to be undesirable. In Rochester, conferees intermixed with RIT students for nine of eleven meals. This worked out very well, however, due in large part to the architecture of the dining hall. As one emerged from the cafeteria line, one could scan down through the tiered eating sections and be quite successful at finding fellow participants and friends. This enhanced participants ability to make new acquaintances, and unquestionably contributed to the success of the conference.

The food was excellent. On one occasion we dined with a very personable hearing-impaired student, CS. He was studying medical technology. He noted that it was "very nice when groups come to campus" because the "food in the dormitory gets better." CS went through the food line three times while we were there! And those large scales at the exit to the dining hall, well, perhaps they would have been better placed at the entrance. For several of us they would have been better located near the ice cream chests.

There was an excellent banquet on Tuesday evening, and a delightful brunch on Thursday morning following the Chemathon '80 race. The prices ($23.50 per person for 11 meals) were incredibly low for such good food.

"Notes 6th"

Our first treat upon checking in was to be handed a copy of "Notes 6th," a three-ring-bound conference book which included abstracts for all papers together with other printed conference materials. The binder was nicely done. This was a particularly thorough and well thought out document. Of all the memorabilia which a nonparticipant might acquire to capture the full impact of Rochester, the approximately 350 pages of "Notes 6th" with its many inserts must rate as #1.

Another comment, the conference logo was both clever and in good taste.

Kudos from the Conference Editor

Hats off to: Alan Hutchcroft who will henceforth be known as The Rockford Rabbit for his smashing victory in the 10km Chemathon '80 race; David Harpp, the Canadian gazelle for his 5km triumph; John Gelder, for his beautifully done poster presentation in CAI; Miriam Nagel, for the best collection of practical safety tips ever heard by this editor; and to the Henry Bents, who brought the audience to its feet in a round of well-deserved applause.

Because so many sessions were held it was necessary to ask many participants to share in the reporting function; 29 reporters were involved. All reporters conscientiously covered these sessions and allowed us to prepare a report which is intended to reflect the spirit of the conference and which complements the abstracts in constituting a conference record. My sincere thanks to these reporters for their accurate and prompt reports.

Finally, Earl Krakower, George Stevens, and Len Fine did an outstanding job. Thank you, thank you for all participants.

In Memorium

James Wilson, Emeritus Professor of Chemistry at RIT and Treasurer of the Sixth Biennial Conference on Chemical Education died in October after a brief illness. He had retired from the Chemistry faculty in August after 34 years of dedicated teaching and service to the chemistry community. The highlight of his last year in the Chemistry Department was his active involvement in the planning of the Biennial Conference, marked by his attention and persistence to the details of fiscal accounting. The successful implementation of the Conference is testimony to his dedication.