Group 1.

New Approaches to the Four Year Curricula

Leader: Dr. Arild Miller, Carleton College

Secretary: Dr. Leland Harris, Knox College

The basis for the discussion was a compilation of curricula from various colleges by Dr. Courtland Agre of Augsburg College (accompanying sheets).

The recent curricula trends indicate a movement of organic and physical chemistry up to earlier positions in the overall curricula. A postponement of analytical chemistry to the third or fourth year accompanying or following physical chemistry was observed. Also, an increasing trend in undergraduate research has been recently related by A. Garrett.

It was generally agreed that exchange of instructors from nonproductive to productive colleges (and vice versa) for limited times would be an inspiring experience leading to higher productivity of weak departments. NSF and Ford Foundation could possibly subsidize such a program.

A discussion of advanced placement of students indicated that many advanced freshman students were permitted to enter the sophomore course in chemistry, skipping the freshman course. These students were generally better in the sophomore course than students who had taken the freshman course.

Combination physics and chemistry courses (along with biology) were discussed as a first year course. The combination course

eliminates the unnecessary duplication involved in these courses. This arrangement requires unusual cooperation between the various participating science divisions.

The Earlham and Brown plan were discussed in detail by L. Strong and L. B. Clapp.

Harvey Mudd (Calif.) (1957)

I. Structure ; Equilibria
(Quant. & Qual.)
II. Physical Chem.
III. Organic
Adv. Inorganic
IV. Adv. Anal. Adv. Physical
Org. Qual.
Seminars & Research

Reed (Ore.)

I.	General & Qual.	5	5
II.	Organic; Quant.	6	5
III.	Adv. Quant.; Adv. Org.	5	4
	Physical Chem.	5	5
IV.	Adv. Courses	✓	✓
	Thesis	✓	✓

St. Olaf (Minn.) (1958)

I. General & Qual.
II. Organic & Lab.
III. Physical (Yr.) (Quant. Lab I. Sem.)
Org. Qual. Adv. Inorg.
IV. Physical (Yr) (Instrument. II. Sem.)
(Adv. Inorganic) Nuclear
Research

Swarthmore (Pa.)

I. General Chem. & Qual.
II. Organic
III. Quant. (Year)
Physical (Year)
IV. Adv. Org., Adv. Inorg.; Electives

Much stress is placed on Honors
Program - 2 Subjects at a time.
Quant. Adv. Calculus
Physical Diff. Equations
Organic Elec. & Mag.
Mol. Struc. Modern Physics

Tufts (Mass.)

I. Structures - Org. & Inorg.
II. Physical Chem.
III. Adv. Inorg. (Year)
Organic (1 Sem.); Quant.
IV. Quant. Research
Various Electives

Augsburg (1959)

I. General - Qual.
II. Organic
III. Quant. (I) Org. Qual. (II)
Physical Chem. (I & II)
(No Lab I) (Lab II)
IV. Physical III
(Lab) (Lab.-Instrumental)
Adv. Inorg. (Adv. Syn. & Nuclear)
(Lab.)
Research (I-II)
Seminar (I & II)

Amherst (Mass.)

I. No Chemistry Math.-Physics Comb.
II. Gen. Chem. + Qual. Anal.
(Plus Quant. for Superior Students)
III. Organic Seminar
Physical
IV. Inorganic Quant. Adv. Org. (±)
Adv. Physical (±) Seminar
Independent Study

Antioch (Ohio) (5 years) (1954)

I. General Qual. Quant.
II. Organic
III. Anal. Theoretical I
IV. Theo. II (Thermodynamics)
Adv. Organic
V. Theor. III (Solutions); IV (Electrodes)
Seminar Comprehensive
Literature Adv. Courses

Brown (R.I.) (1948)

I. Organic (Covalent Bond)
(Also Atomic Structure)
II. Molecular Structure Inorganic
Physical Chemistry (Year)
III. Organic (with Qual.) Analytical
. Advanced Courses

Carleton (Minn.) (1959)

I. Chem.-Physics Combination
(Like Wabash & Beloit Plans)
II. Equilibrium; Analytical
III. Organic (Year) Literature *
*Structural Inorg. Thermodynamics
IV. Kinetics *Transport Processes
*Electroanal. *Adv. Organ. & Qual.
Comprehensive (*Elective)

Earlham (Ind.) (1957)

Divides subject matter into Basic Concepts

Sem. I. Elements (usual Lab.)
II. Covalent Bond (Quant. Lab.)
III. Ions, simple and complex
IV. Electrode Reactions
V. Resonance
Then Advanced Topics - Stereochem., Mechanisms, Kinetics, Thermo.

Johns Hopkins (1959)

I. General & Qual. Section to ability. Few major expts. Have Thermo. and Quantum Mechanics.
II. Quant. ; Organic
III. Adv. Quant.; Org. Qual.
Physical
IV. Adv. Courses

CHEMISTRY CURRICULA

University of Minnesota (1956)

Year I			
General Chemistry	5	5	5
Mathematics (Trig.)	5	5	5
English Composition & Lit.	5	5	5
or			
English Comp.	3	3	3
Eng. Drawing		2	2
Year II.			
Organic	4	4	3
" Lab.			3
Calculus	5	5	
Diff. Equations			4
General Physics	5	5	5
Year III.			
Quantitative Anal.	5	5	
Organic Qual. Anal.	4		
Physical Chem.	4	4	4
Atom. Struc. etc.	3	3	
German	3	3	3
Year IV.			
Phys. Chem. Lab.	2	2	
Senior Thesis	3	3	3
Adv. Inorg. Lab.			2
Instrumental Anal.	3		
Electrometric		2	
Lab. (Ins. or Elec.)		1	
(Electives { 24 Science, 36 Non-")			

California Institute of Tech. (1956)

Chem. (Quant. Lab.)	4	4	4
Math. (into Int. Cal.)	4	4	4
English	3	3	3
History (Europe)	2	2	2
Graphics	1		
Physics	4	4	4
Organic & Lab.	4	4	4
Calculus & Diff. Eq.	4	4	4
Adv. Physics	4	4	4
History (U.S.)	2	2	2
Geology; Biology	5	4	
Adv. Quant. Anal.	4		
Economics		3	3
German	4	4	4
Phys. Chem. & Lab.	3	5	5
Literature	3	3	3
Electives (Sci.)			
Humanities	3	3	3
Public Affairs	1	1	1
Electives (Sci. *)	12	12	12

* 29 Choices

(94 on Chem. Staff in 1958).

Massachusetts Inst. of Tech. (1957)

Chem. & Qual.	✓	✓
Calculus	✓	✓
Western Civil.	✓	✓
Physics	✓	✓
Electives	✓	✓
Organic & Lab.	✓	✓
Calculus & Diff.	✓	✓
Physics	✓	✓
Humanities	✓	✓
Language	✓	
Electives	✓	✓
Inorg. // Quant.	✓	✓
Organic Qual.	✓	
Physical C. & Lab.	✓	✓
Humanities	✓	✓
Electives (Sci.)	✓	✓
Inst. Anal.	✓	
Thesis	✓	✓
Humanities	✓	✓
Electives (Sci.)	✓	✓

Group 2

What to Do About Inorganic Chemistry

Leader: Dr. Henry Taube, University of Chicago

Secretary: Dr. Joe Danforth, Grinnell College

Approximately 25 persons attended What to do About Inorganic Chemistry. Six of the group offered courses beyond general inorganic chemistry. Five of the six used Gould.

The phases of Inorganic Chemistry which should be taught were listed and rated for time allotted on a scale of 1 to 10. Many of the important topics to be introduced in the undergraduate curriculum are described by Sissler in J. Chem Ed 36, 515 (1959). After deciding what theoretical concepts should be presented, the descriptive material to be used:

Frey	Qualitative most of sec.
Sienko & Plane	Sec. Semester Qualitative
Frey	Lots of analytic in lab. 1 Sorum. 3.65 set of weights.
Frey	Qualitative second semester (Sorum)
Schwenk & Martin	No organic Qualitative
King & Caldwell	Qualitative Second semester

Sissler & Vand Davidson - de-emphasize qualitative

Descriptive and factual material is important but should be used as it illustrates principles.

The problem of quantitative experiments in freshman chemistry was discussed. One school has solved their problem of provision of weights by having the students purchase their own ($3.65) (the

bookstore buys them back).

The time was gone before we could consider the laboratory part of inorganic chemistry.

Modernization of Organic Chemistry

Leader: Dr. Quentin Petersen, Wabash College

Secretary: Dr. Kurt Kaufman, Kalamazoo College

I. Introduction remarks by the group leader, Dr. Quentin Petersen, Wabash College, outlined a framework for discussing the topic.

A. Elementary Organic Chemistry lecture and laboratories.

B. Advanced Organic Chemistry courses.

C. Research as a part of undergraduate instruction in Organic Chemistry.

II. Elementary Organic Chemistry lectures:

Discussion of this topic disclosed that none of the colleges represented are offering Organic Chemistry in the freshman year, with the exception of a few terminal courses for non-chemistry majors. About one-half of the group now have organic chemistry to the sophomore year. Only two colleges offer two courses in elementary Organic Chemistry, one course for majors, another for non-majors. The non-major course is generally less theoretical and more descriptive including more discussion of compounds of biological interest.

Much discussion centered on the recognized trend toward the introduction of mechanistic considerations in the elementary organic course. There was not general agreement on the desireability of a mechanisms-centered introduction to Organic Chemistry as evidenced by the diversity of texts adopted. Our group, which represented 26 colleges, was using more than ten different texts,

varying greatly with their approach.

III. Elementary Organic Chemistry laboratory

Roughly half of our group are involved in courses with two three-hour scheduled laboratories per week. The remainder have one laboratory afternoon scheduled.

A number of devices to include the use of the library are used in most of the laboratory sessions. Examples cited were: preparations not described in the laboratory manual and written reports to include information not found in the manual. Roughly half of the group has shifted to laboratory work on a semi-micro scale.

Considerable discussion disclosed that a number of colleges are devoting all or part of the second semester to qualitative Organic Analysis in the laboratory. Those that are doing this are well pleased with the result and feel particularly that the student finds such a laboratory experience more stimulating than the more conventional experiments.

At least six of the colleges represented have introduced the use of instruments, eg. spectrometers, refractometers, polarimeters, etc., in the laboratory work. A larger number have some experience with chromatography.

IV. Advanced Organic Chemistry courses.

Sixteen of the colleges have at least one semester of work beyond the elementary organic year. Most of these are qualitative organic analysis courses. Three colleges offer a full year of advanced organic work.

Again, diversity of texts was the rule for advanced courses other than qualitative organic with the general agreement that the proper subject for such a course was a mechanisms presentation.

Seven of the schools offer work in biochemistry but there was disagreement on the desirability of this practice.

V. Research in Organic Chemistry.

Two colleges require a research project (though not necessarily organic) for graduation as a chemistry major. Most of the representatives felt that such an experience is extremely valuable. It was pointed out that qualitative organic analysis frequently interferes in the first semester of the senior which was accepted as a valid argument for moving elementary organic to the sophomore year and qualitative organic to the junior year.

Group 6

Advanced Standing and the Superior Student

Chairman: Dr. Bayes Norton, Kenyon College

Secretary: John Hower Scott, Macalester College

The chairman outlined the history and present state of the program on admission with advanced standing conducted by the College Board. The following points in particular were made:

1. There were about 6,000 high school student, taking 9,000 exams, involved this year.
2. Most students qualify or try to qualify in only one or two subjects.
3. A real college level course should be involved and not mere passing of an examination. Three semesters in high school is the minimum. Kenyon has normally insisted on four semesters, but has accepted three from a real college type course plus a high grade.
4. At Howard 98% have not used advanced standing to graduate early.
5. The high school teachers are quite concerned that the advanced standing carry credit. There was some question as to whether this would not militate against using the time gained for senior research since the major was right up to a 44 hour college imposed maximum. Most felt that such maxima did not prevent research which did not carry credit and such students should be those who would take part in such programs.

Then the question of the extra good high school course which was not of full college caliber was discussed. A one semester special section to fill in the deficiencies was felt to be one solution. But what to follow this with in the second semester was the problem. Quantitative analysis is often the only opening course. Valparaiso has admitted some such persons to organic an admission and insisted that they then take (advanced) inorganic.

This was lst period.

In second period the point was made that high school teachers giving such courses need both more time to conduct them and more training to make them capable of doing so than is usually required of high school teaching.

Radiochemistry in the Curriculum

. Report

to the Eighth Annual Meeting of the Midwestern Association of

Chemistry Teachers in Liberal Arts Colleges

I. Reasons for incorporating a significant amount of Radiochemistry into the Liberal Arts Curriculum.

A. Related subjects are an important part of general education. Application and consequences of nuclear processes are a social force.

B. Because of familiarity of such things as the atom bomb, hydrogen bomb, and intrastellar fusion processes, the subject has great appeal to the student.

C. The fundamental nature of many of the concepts requires that they be included, whether or not the entire area of radiochemistry is recognized.

D. There is great cultural value in the history of the development of this area.

E. Techniques of radiochemistry facilitate the demonstration of many chemical phenomena which might be difficult to show otherwise.

II. Manner of incorporating radiochemistry into the Liberal Arts Curriculum.

A consensus supports the integration of certain parts of radiochemistry in existing courses, rather than the establishment of a separate course for this purpose.

A. General Chemistry

1. Lecture subjects of vital importance and which are appropriate for general chemistry include: the matter-energy relationship, the origin of the elements, the transmutation of elements, the synthetic elements and aritificial radioactivity, the use of isotopes and radiation in modern and historically important studies.

2. A number of experiments and demonstrations are available for use in general chemistry. In addition to the standard literature, industrial and AEC literature provide some examples. Also, certain individuals have worked some of these out in detail; however, the procedures are not all published. The panel makes the following recommendation. Those having such experiments should write them up and send 100 copies to the president of this organization, if he concurs in acting as a clearing house for this purpose.

3. The availability of isotopes and equipment for teaching purposes has been considered. Licence-free isotopes are commercially available, the AEC has a policy of providing equipment of the needed types for educational purposes. Again, literature is available.

B. Analytical Chemistry

1. The most probable inclusion of radiochemistry would extend only to certain well planned experiments in which substances are analyzed without study of the detailed aspects of counting techniques.

2. The relative virtue of certain radiometric methods versus classical methods should be an area of interest. Problems uniquely soluble by radiochemical methods are perhaps most promising.

3. Quite a few experiments have been worked out. The Nuclear-Chicago Corp. can provide detailed instructions for several of these.

C. Physical Chemistry

1. This would be the appropriate course to provide an evaluation of counting techniques, errors, etc.

2. The technique might add interest to some relatively classical experiments.

D. Organic Chemistry and Biochemistry

1. If found practical, such things as rearrangements and solvalysis reactions might form the bases of radiochemical experiments. In general, the type of information obtained will be at a higher educational level in the case of organic chemistry. Some relatively simple biochemical experiments are readily available.

2. Because of the nature of the radioisotopes required, instrumentation may be more expensive in this area.

E. Undergraduate Research

1. Space problems may be encountered.

2. Problem of radioactive wastes should be confronted during planning stages. AEC and/or State Universities may be able to help with disposal.

3. Apparatus should be available from foundations through grants. The Wooster report shoudl provide useful details in this regard. Government surplus supplies may merit investigation. School business offices are sometimes well informed on this score, although they may not generally let it be known.

F. Advanced Courses

As some schools offer such advanced courses as instrumental analyses, qualitative organic, advanced inorganic, etc., these might provide a fertile area for application.

III. Training of Faculty

A. The government laboratories have in the past, hired some college teachers for summer jobs under circumstances such that an opportunity was had for the learning of radiochemistry.

B. Some of the NSF summer institutes have been devoted to radiochemistry, e.g., Cornell College.

Respectfully submitted,

Daryle H. Busch

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