INFORMATION TO USERS

This material was produced from a microfilm copy of the original document. While the most advanced technological means to photograph and reproduce this document have been used, the quality is heavily dependent upon the quality of the original submitted.

The following explanation of techniques is provided to help you understand markings or patterns which may appear on this reproduction.

1. The sign or “target” for pages apparently lacking from the document photographed is “Missing Page(s)”. If it was possible to obtain the missing page(s) or section, they are spliced into the film along with adjacent pages. This may have necessitated cutting thru an image and duplicating adjacent pages to insure you complete continuity.

2. When an image on the film is obliterated with a large round black mark, it is an indication that the photographer suspected that the copy may have moved during exposure and thus cause a blurred image. You will find a good image of the page in the adjacent frame.

3. When a map, drawing or chart, etc., was part of the material being photographed the photographer followed a definite method in “sectioning” the material. It is customary to begin photoing at the upper left hand corner of a large sheet and to continue photoing from left to right in equal sections with a small overlap. If necessary, sectioning is continued again — beginning below the first row and continuing on until complete.

4. The majority of users indicate that the textual content is of greatest value, however, a somewhat higher quality reproduction could be made from “photographs” if essential to the understanding of the dissertation. Silver prints of “photographs” may be ordered at additional charge by writing the Order Department, giving the catalog number, title, author and specific pages you wish reproduced.

5. PLEASE NOTE: Some pages may have indistinct print. Filmed as received.

Xerox University Microfilms
300 North Zeeb Road
Ann Arbor, Michigan 48106
74-3116

BATCHELLOR, Robert William, 1939-
THE DEVELOPMENT OF THE GENERAL CHEMISTRY PROGRAM
AT THE OHIO STATE UNIVERSITY.

The Ohio State University, Ph.D., 1973
Education, higher

University Microfilms, A XEROX Company, Ann Arbor, Michigan
THE DEVELOPMENT OF THE GENERAL CHEMISTRY PROGRAM
AT THE OHIO STATE UNIVERSITY

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Robert William Batchellor, B.S., M.S.

* * * * * * * * * * *

The Ohio State University
1973

Reading Committee:
Hugh D. Laughlin
Walter G. Hack
Robert J. Ouellette

[Signature]

Adviser
Department of
Educational Administration
ACKNOWLEDGEMENT

The author wishes to express his gratitude to all those people who have aided and encouraged him in this work, especially Professors Hugh Laughlin, William T. Lippincott, Walter Hack, and Robert Ouellette.
VITA

January 3, 1939 .............. Born, Rochester, New York

1960 .................................. B.S., Saint Francis College, Loretto, Pennsylvania

1960-1963 ......................... Teaching Assistant, Department of Chemistry, The Ohio State University, Columbus, Ohio

1963-1964 ......................... DuPont Teaching Fellow, Department of Chemistry, The Ohio State University, Columbus, Ohio

1964-1967 ......................... Parttime Instructor, Department of Chemistry, The Ohio State University, Columbus, Ohio

1967 .............................. M.S., The Ohio State University, Columbus, Ohio

1967-1973 .......................... Teaching Associate, Department of Chemistry, The Ohio State University, Columbus, Ohio

FIELDS OF STUDY

Major Field: Higher Education

Studies in Higher Education: Professor Hugh Laughlin

Studies in Chemistry: Professor W. T. Lippincott

Studies in Adult Education: Professor John Ohliger
# LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Enrollment in General and Agricultural Chemistry 1890-91 to 1894-95</td>
<td>61</td>
</tr>
<tr>
<td>2</td>
<td>University Enrollment - 1916 - 1918</td>
<td>115</td>
</tr>
<tr>
<td>3</td>
<td>Chemistry Buildings at Various Universities</td>
<td>127</td>
</tr>
<tr>
<td>4</td>
<td>Comparative Income and Enrollment for the Period 1930-31 to 1936-37</td>
<td>196</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>ACKNOWLEDGEMENTS</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>VITA</td>
<td>iii</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td>iv</td>
</tr>
</tbody>
</table>

## CHAPTER

1. **Introduction.**
   - General Background .................................................. 1
   - Specific Background .................................................. 9
   - Statement of the Problem ............................................ 11
   - Design ........................................................................... 16

2. **The Norton Years.**
   - The Establishment of the Department ..................... 24
   - Early Organization ................................................... 28
   - The Philosophy and Methods of Norton .................. 33
   - A New University Organization ............................. 50
   - The Conflict Over Laboratory ............................. 60

3. **The McPherson-Henderson Years.**
   - Expansion of the Department .................................. 67
   - Attempts at Consolidation and Correlation ............. 76
   - Correlation with the High Schools ...................... 78
   - Consolidation of the Introductory Courses ............ 81
   - Correlation with Other Colleges .......................... 93
   - Movement Toward University Status .................... 96

4. **The Evans Era.**
   - The Effect of World War One ............................... 115
   - Development of Conflict ........................................ 121
   - The Situation in the Department of Chemistry ........ 124
   - The Freshman Problem .............................................. 128
   - The General Chemistry Division .......................... 144

5. **The Day, Fernelius, Quill Era.**
   - The Organization of the General Chemistry ............ 161
   - Attempts at a Broader Coordination of Elementary
     Courses ........................................................................ 178
   - Effect of the Depression ........................................ 188
   - The People Involved with the Division of General
     Chemistry ................................................................. 201
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>VI. The Mack-Garrett Era</td>
<td>216</td>
</tr>
<tr>
<td>A Change in Priorities</td>
<td>216</td>
</tr>
<tr>
<td>The Chemistry Department After the Depression</td>
<td>244</td>
</tr>
<tr>
<td>VII. Summary</td>
<td>259</td>
</tr>
<tr>
<td>The Methods Used in the Introductory Courses</td>
<td>259</td>
</tr>
<tr>
<td>The Organization of the Introductory Courses</td>
<td>261</td>
</tr>
<tr>
<td>The Administrative Organization of the Introductory Program</td>
<td>268</td>
</tr>
<tr>
<td>The Effect of Other Goals on the General Chemistry Division</td>
<td>271</td>
</tr>
<tr>
<td>Concluding Statements</td>
<td>276</td>
</tr>
<tr>
<td>SELECTED BIBLIOGRAPHY</td>
<td>280</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

It has become common in the 1960's to portray the American University as an institution serving society through research, teaching, and public service. Analysis of the problems of higher education often disagree on the way these functions should be related to each other. They often agree, however, that none of these purposes can be ignored, that each often conflicts with the others, and that these conflicts usually result in highly complex problems of management. This conclusion underlies their analyses and, in their view, results in the need for thoughtful inquiry into the governance of higher education.¹

General Background

The present organizational structure of universities according to departments is the result of a long historical development. The medieval university recognized the need for division of labor. It was usually organized into four faculties: law, theology, medicine, and arts. While further subdivision was slow in developing, eventually professorships in distinct subjects in the arts began to emerge as the masters began to lecture from the same book or books.

The early American college of the seventeenth and eighteenth century was a simpler institution than the medieval university.

Harvard was originally modelled after a single college of an English university. There was no need for a differentiated faculty in an institution which had a high degree of unity of purpose and a small number of students. The students were organized into classes, which consisted of all who enrolled in a particular year. The class all took the same prescribed curriculum over a four-year period. A single tutor could teach the whole year's curriculum, and in some cases taught the class for all their years of study. This method of teaching made great demands on the knowledge of the tutor even with the limited curriculum offered in the early college.

Gradually the teacher began to specialize. This was enhanced by the addition of mathematics and science to the curriculum. In 1708, one of the Harvard tutors devoted his efforts to science. By 1767 tutors were specialists; one for Latin, one for Greek, one for logic, metaphysics, and ethics, and another for natural philosophy. However, all four taught English composition, rhetoric and elocution. Thus the professorial chair still remained rather broad.

---


5 Brubaker and Rudy, *Transition*, p. 83.
Expansion of the enrollments in the early nineteenth century and consequent increase in teaching staffs resulted in several professors or tutors lecturing in the same discipline. In 1825 Harvard was reorganized into six departments. At the same time upperclassmen were permitted a limited number of electives. This recognized and further set in motion a demand for democratization and liberalization of higher education that was gradually met.

In 1869, Charles W. Eliot, a chemist, was elected president of Harvard. He had a firm commitment to the elective system and slowly was able, during his forty-year administration, to get the system accepted. By 1874-1875 all required courses at Harvard were limited to the freshman year. The elective system fostered expansion in curriculum which enhanced the departmental form of organization. By 1870-71 courses at Harvard were listed in the catalogue according to departments. In 1881, courses were subdivided into half-courses.

Several other factors contributed to the expansion of curriculum and departmentalization. The Morrill Acts of 1862 and 1890 fostered scientific and technical instruction in land-grant colleges and universities. The tendency of the American People to that which


7 Brubaker and Rudy, *Transition*, p. 200.

8 Ibid., pp. 110-111.

9 Ibid., p. 115.

10 Ibid., p. 116.
is practical and the emphasis on the utilitarian values of higher education led colleges and universities to respond by offering more professional courses. The introduction of engineering, agriculture, and education justified the formation of additional departments. The expansion of knowledge itself was to a large degree responsible for new areas of specialization and consequent departmentalization. New fields of study were emerging and the old ones were subdividing and each attempted to establish the boundaries of its own specialty through the formation of a department.

In addition to the departmental form of organization, the American university took on additional goals. Advances in science had given great prestige to the experimental and investigative research done in Germany. Many Americans traveled to Germany to study in the German universities. There they assimilated the German ideal of a university. These German-trained professors began to dominate American college faculties by the late nineteenth and early twentieth century. Being specialists, they sought identification with their field of study through the departmental system. The departments began to emphasize the new goals of training specialists and research.

---

11Ibid., p. 118.
12Ibid., p. 117.
13Dressel and Reichard, Departments, p. 395.
Gradually the power of university departments grew as the reputation of a university came to depend more on the reputation of the departments. The reputation of the department was measured on the basis of the norms established by the discipline on a national or international level and not on local norms established by the university. It was difficult for non-specialists in the local university community to pass judgment on the specialized research and instruction performed by faculty members. Thus the department, the basic organizational unit of the university, became somewhat autonomous. This tendency toward a national rather than an institutional orientation was enhanced after World War II by the federal funding of research projects which gave departments an economic leverage that they had not previously enjoyed. Federal funding also led to an expansion of the goals of graduate education, research and public service.

Today the university is pictured as an organization with multiple goals: the traditional goal of undergraduate instruction, the German ideal of graduate education and scholarly research, and the practical American ideal of public service. The attainment of these goals has been left largely in the hands of the departments, although certain aspects of public service have sometimes been delegated to special university units.

\footnote{Ibid., p. 395.}
A number of observers see conflict resulting from the multiple goals of today's university. Millett\textsuperscript{15} sees the following difficulties:

1. The relationship between undergraduate and graduate instruction.
2. The relationship between the disciplines and the professional fields.
3. The relationship between instruction and research.

He feels that these conflicts are seldom resolved in organizational terms satisfactory to all members of the academic community.

The difficulties regarding undergraduate and graduate instruction and instruction and research are generally focused at the departmental level of university organization. Few, if any, institutions have achieved "a balance of talent" at the departmental level between these goals.\textsuperscript{16}

Actually at the undergraduate level two types of undergraduate instruction exist. Millett writes:

We may note here that at the undergraduate level there are actually two different kinds of instruction. On one hand, the introductory and core courses a department offers are often intended for the non-specialist, although these courses may also serve the beginning specialists. On the other hand, there are the specialized courses to be provided at undergraduate level which afford the professional educational achievement expected for a baccalaureate. Both kinds of instruction, the general and the specialized, are important at the undergraduate


\textsuperscript{16}Ibid., p. 87.
level. Sometimes the educational importance of this general instruction is emphasized organizationally by the establishment of a general college as a coordinating structure.\textsuperscript{17}

The kind of instruction designed for the undergraduate major or an undergraduate in a closely related field will be in less conflict with the goals of graduate instruction and research than is the kind of broad instruction geared to the non-specialist. The most intense problem arises in the introductory courses where there are a large number of students who are not interested in the discipline as a speciality but need a broad introduction to the area. This situation arises generally in the traditional disciplines, such as history, chemistry, and English where large number of non-majors take introductory courses.

Dressel and Reichard\textsuperscript{18} feel that the goal of providing general introductory programs is so in conflict with the other goals of university departments that these programs are "best supplied by autonomous, non-departmental organized colleges, with facilities and faculty devoted to continuing involvement with individuals and problems of instruction". They feel this should result in "a more functional, rational allocation of resources and evaluation of cost-benefit ratios". A division of salary and accountability would also avoid a situation where allocations are made to a department for one set of goals and used to promote a different goal.

\textsuperscript{17}Ibid., p. 90.

\textsuperscript{18}Dressel and Reichard, \textit{Departments}, p. 396.
Kay T. Andersen on the other hand feels that "throughout the history of higher education, the concept of departmentalization has provided that milieu most suitable for the development, preservation, and transmission of knowledge". Andersen sees the problem largely in terms of "the formation of a workable partnership among departmental faculties, administration, and students to strive for the identification and internalization of dominant values within a basically decentralized system".

A manifestation of the fact that the introductory undergraduate program entails different kinds of problems than research and graduate education is the development of subdivisions within the departments which have as their primary responsibility these programs. These subdivisions may range in organizational complexity from one man coordinators to organizations which are larger and more complex than some departments. These subunits are found almost exclusively at larger universities in departments which have extensive responsibilities for providing undergraduate instruction. For example, virtually every chemistry department at major universities has such a subunit. An understanding of the development of these units is fundamental to understanding and acting upon one of the problem areas of higher education. Yet this area has been ignored by writers on higher education.

Specific Background

The Chemistry Department of the Ohio State University provides an example of a department which has had the responsibility of providing introductory programs to large numbers of undergraduate students since the beginning of the University. It was one of the ten original departments at Ohio State. Expansion of the University in its offerings, the number of students, and its goals, together with the expansion of knowledge and availability of resources have, over the years, led the Department to the point where it has a very strong commitment and reputation in the area of graduate instruction, research, and undergraduate instruction.

The growth and increase in complexity of the Department, along with the special problems associated with providing introductory undergraduate programs, led to the establishment of the Division of General Chemistry. The Division of General Chemistry has the responsibility of providing for the planning, operation, and support of the introductory courses in chemistry. Today this division enrolls each quarter approximately 3600 students in ten different courses and 15-20 lecture sections and 120-140 laboratory and recitation sections. It employs 75 teaching assistants and associates, 100 student assistants, and 25 staff members, in addition to using the services of the senior faculty of the department. The division controls its own storeroom facilities, laboratory preparation facilities, general chemistry office, independent television distribution system, facilities for making films and television tapes,
Filmed as received

without page(s) 10.

Unavailable for microfilming.

UNIVERSITY MICROFILMS.
lecture-preparation facilities, and teaching laboratories. The Division also has charge of similar facilities consisting of seven laboratories, a television distribution system, general chemistry office and storeroom located at the new West Campus facilities of the Ohio State University. While it is not possible to separate completely the budget of the Division from the Department, some idea of the size of the budget can be seen from the fact that approximately $400,000 is budgeted for the Division in the area of temporary and junior staff. The total cost of operating the program is well in excess of $600,000 per year.20

Statement of the Problem

Purpose

This investigation is concerned with the history of the development of undergraduate instruction in the Department of Chemistry at the Ohio State University, with emphasis on the introductory courses. The investigation centers on the following areas:

1. The teaching methods used in the introductory courses.
2. The organization of the introductory courses.
3. The administration of the introductory courses.
4. The effect of multiple goals on the manner in which the department and institution organizes themselves to meet their responsibilities in offering introductory undergraduate courses.

20Data and approximations obtained through the Office of General Chemistry.
The objectives of the investigation are:

1. To provide an accurate accounting of the development of undergraduate instruction in the department in the areas outlined.

2. To identify factors that may have influenced the development and administration of undergraduate instruction in the department in the areas outlined.

3. To interpret the findings relating the past to the present situation in order to better understand the conditions as they exist today.

Significance of the Study

There are a number of basic areas in which this investigation has significance.

1. It provides a record of the development of introductory undergraduate instruction and administration in a department which is successful in terms of its standing in the discipline. Thus the study has historical significance.

2. It helps to increase understanding in one of the important problem areas of higher education by providing an example of how the department has attempted to provide introductory undergraduate programs.

3. It helps to increase understanding of administration in general by providing an example of how an organization has reacted to the problem of multiple goals.
4. It investigates an area of university organization which has received scant attention, yet has responsibility for a significant area of university endeavor.

It has been said that the "base for a science of educational administration lies in the unique character of the problems, issues and behaviors that comprise education". Corson views the organizational forms and practices of the university as unique.

This uniqueness has its roots in academic tradition. But this uniqueness arises too from the nature of the functions performed by an educational enterprise; they are different functions requiring a different organization and different practices than are common in business or governmental enterprises.

While it is difficult to define precisely all the functions of a large university, it is generally agreed that these functions relate to three primary purposes: instruction, research, and public service. Furthermore, as these functions developed over the years, certain factors, such as the expansion of knowledge, resulted in much of the responsibility for educational policy and practice lying in the hands of somewhat autonomous departments.


23Millett, Community, p. 33.

24Corson, Governance, pp. 85-87.
Millett\textsuperscript{25} views as one of the "perplexing difficulties" of university organization the relationship between instruction and research and between undergraduate and graduate instruction. He states:

It is at the departmental level of academic organization where conflict especially occurs between undergraduate and graduate instruction. No university seems to have resolved the problem of achieving a balance of talent at the departmental level devoted both to undergraduate and graduate instruction.\textsuperscript{26}

As has been noted in this introduction, much of the problem focuses on the area of providing general, non-specialized undergraduate instruction. Some observers of the scene in higher education have suggested that the department is "an excellent -- perhaps the best possible -- organization for the professor concerned with research, graduate education, and national recognition", but that the provision of general introductory courses in an academic area is best handled outside of the departmental system.\textsuperscript{27} Many others agree that this form of education can best be provided within the department, by those persons who are at the frontiers of their discipline.

How to best provide this form of undergraduate instruction is one of the major problems facing universities today. It is only

\textsuperscript{25} Millett, \textit{Community}, p. 78.

\textsuperscript{26} \textit{Ibid.}, p. 87.

\textsuperscript{27} \textit{Ibid.}, p. 88.
in the light of their origin and growth that the educational problems of the present can be viewed sympathetically and without bias by the teacher, the administrator, or the public.\textsuperscript{28}

In a more general sense the study provides an example of the developments in an organization which has taken on additional goals over the years. This entails a more general problem that the specific areas of study proposed in this paper. While the aim of any science, including educational administration and administration in general, is the explanation and prediction of phenomena, this must be preceded by an understanding and description of the present situation and how this situation developed. This description can be enhanced by historical study.

Despite the importance of the problem to higher education, little study has been done on departments and nothing on organizational units such as the Division of General Chemistry. Moran\textsuperscript{29} points to the scarcity of research on university organization in general and the fact that universities have had to respond to pressures with no sense of knowledge of its impact.

With deference to those who have written about the department, it is perhaps fair to say that no other vital area of higher education has been so inadequately researched.

A comprehensive study of the department would provide separate treatment of the department as the product of a long evolutionary process and as an


administrative unit in colleges of various sizes and types, of the chairman as the key administrative officer in the college, of intra- and inter-departmental relationships, of the development and transmission of knowledge within particular departments, and of the role of the department in an open system.30

Historical Research

Historical research is an attempt to reconstruct the past.31 Historical methodology is a systematic body of rules and procedures for collecting all possible evidence of an era or event, evaluating the evidence, ordering the proven facts in causal connection, and finally, for presenting this ordered knowledge of events.32

The Social Science Research Council has summarized the importance of historical research as follows:

Historiography has a necessary relevance to all the social sciences, to the humanities, and to the formulation of public and private policies, because (1) all the data used in the social sciences, in the humanities, and in the formulation of public and private policies are drawn from records of, experiences in, or writings about the past; (2) all policies respecting human affairs, public or private, and all generalizations of nonstatistical character in the social sciences are interpretations of or assumptions about the past, and because

30Andersen, Department, pp. 206-207.


(3) all workers in the social sciences and in the humanities are personalities of given times, places and experiences whose thinking is consequently in some measure conditioned and determined by the historical circumstances of their lives and experiences.33

In the field of education historical research is needed because "... it is necessary to know and understand educational accomplishments and developments of the past in order to gain a perspective of the present and possibly future directions".34

The evidence for an era or event is obtained from documents. A document may be defined, in a broad sense, as any impression left by a human being on a physical object.35 Thus it includes both written and non-written impressions.

The evidence obtained from documents must be examined carefully as to the validity of the same. Some are classified as primary or secondary.36 Primary sources have a direct relationship to the era or event being studied. Secondary sources have an indirect relationship to the event or era being studied. There can be problems of validity with both primary and secondary sources. The secondary sources, by their very nature, are apt to contain substantial distortions. Sources are subjected to two forms of criticism, external

34Ibid., p. 698.
35Travers, Research, p. 111.
36Ibid., p. 115.
and internal.\textsuperscript{37} External criticism involves two aspects. One is to determine the authenticity of the source. The second is the evaluation of the source to see if the document is a sound source of information.\textsuperscript{38} Internal criticism involves evaluating the meaning and trustworthiness of the data with the source. The concern is with the credibility and author's meaning of each statement.

After the sources have been examined, the inferences made from these sources can be ordered into causal connection. While the principal task of historical research is to give a factual picture of past events and conditions, it should not stop with summarizing isolated facts, but should organize the material into an interpretive narrative.\textsuperscript{39} It is here that the historian must be especially careful in the use of the concept of causation. He is not dealing with the relatively clear-cut cases of cause and effect that the physical scientist deals with in the controlled situation in the laboratory, but with causes which are antecedents, precipitating, or contributing factors, perhaps, but not clear-cut cases of cause and effect.\textsuperscript{40}


\textsuperscript{38}Travers, \textit{Research}, p. 118.


\textsuperscript{40}Travers, \textit{Research}, p. 121; Mouly, \textit{Research}, p. 214.
Limitations

There are a number of limitations inherent in historical research. The reconstruction of a model of the past can never be perfect or fully achieved. There is always an element of doubt as to how close the written history is to the reality of the past events. Language itself provides limitations in the reconstruction along with the subjectivity of the writer and the availability of sources.

The necessary use of secondary sources involves the problem of accepting the interpretation of others whose view of the event may be colored by personal values and prejudices. Often an institution and its subdivisions do not maintain as complete a record as possible of its activities and often the official record contains only that which the participants wish to appear in the public record.

Definitions of Terms

1. Introductory Courses -- courses intended to serve as an introduction or first level course in chemistry.
2. Service Courses -- courses offered by a department which primarily enroll students who are not majoring or intending to major in that field.
3. Teaching Methods -- the relationship established by the department for the purpose of diffusing knowledge among a group of students.41

4. Organization of the Introductory Courses -- refers to the subdivisions of courses according to content, methods or publics served at the introductory level.

5. Division of General Chemistry -- that organizational subunit of the Department of Chemistry which has responsibility for the operation of the introductory courses in chemistry.

Plan of the Research

Preliminary study of the Division of General Chemistry and the history of the Chemistry Department indicated that the study could be divided into five historical eras. These eras were identified according to the individual or group of individuals who exemplified chemical education at Ohio State at different times.\(^{42}\)

1. Norton Era -- Sidney A. Norton was the second appointment made by the first Board of Trustees in 1873 to the faculty. He served as chairman from 1873-1895.

2. McPherson-Henderson Era -- William McPherson served as chairman of the department from 1895-1928. William Edward Henderson was appointed to the faculty in 1899. He collaborated in a series of very successful textbooks and laboratory manuals with Professor McPherson. These books did quite a bit to make the department known nationally.

\(^{42}\) Most of the facts contained in the following sketches were obtained from The History of the Department of Chemistry by Earle R. Caley. This is a brief history of the department published in 1970 by the Department for the centennial of the Ohio State University.
3. Evans Era -- William Lloyd Evans was named assistant professor in charge of the course in general chemistry in 1905. He served as chairman of the department from 1928-1941.

4. Quill, Fernelius, and Day Era -- Jesse Day, W. Conrad Fernelius, and Lawrence L. Quill all took an active role in chemical education. Jesse Day served the department from 1923 until his death in 1935. His major interest was the teaching of first-year chemistry. W. Conrad Fernelius was appointed instructor in 1928 and continued with the department until 1942 when he resigned to accept a professorship at Purdue University. Lawrence L. Quill was appointed assistant professor in 1935 and continued with the department until 1942 when he accepted the chairmanship of the chemistry department at the University of Kentucky.

5. Mack-Garrett Era -- Edward Mack, Jr. served the department as chairman from 1941 to 1955. Alfred B. Garrett was appointed instructor in 1935 and served the department as chairman from 1960 to 1962. Mack and Garrett collaborated on textbooks and laboratory manuals.
These eras were examined in the area of introductory undergraduate programs to determine:

1. The teaching methods used in the introductory courses.
2. The administrative problems in the introductory program.
3. The organization of the courses in the introductory program.
4. How the Department and University organized themselves to provide introductory courses.
5. The factors which have influenced developments in these four areas.

The study assumed that changes in the five areas mentioned resulted from factors arising from within the department of chemistry, from within the university community, from the discipline itself, and from the greater society. Therefore in interpreting the development of the introductory program an attempt was made to identify the following factors in so far as they related to the problem:

1. The number and needs of the students.
2. The needs of other university units and departments.
3. The goals and orientation of the university.
4. The philosophy and orientation of the faculty members of the department.
5. The resources available.
6. Changes and expansion in the discipline.

7. General societal pressures affecting higher education.

The sources used in this study included the following:

1. Records of the department of chemistry.

2. Records contained in the University Archives.

3. Textbooks and periodicals written by members of the chemistry department.

4. Records kept by university units other than the archives and chemistry department that have a bearing on this problem.

5. Personal interviews.

6. The written history of the Ohio State University.

7. Various histories of higher education.

The scope and depth of the study was limited by the availability and existence of the necessary data. Furthermore, since this study was concerned with the development of the introductory program in chemistry at a specific institution and not broader topics of higher education and the greater society, secondary sources were to some extent relied upon to identify factors outside the department of chemistry. The study is not intended to provide a complete and detailed history of the area, but rather to provide the reader with an overview of the people, conditions and problems related to the developments in this area.
CHAPTER II

THE NORTON YEARS

The Establishment of the Department

The passage of the Morrill Land Grant Act of 1862 served as the basis for the founding of the Ohio State University and the establishment of its Department of Chemistry. Initially there had been little interest in Ohio in making use of the Morrill Act. It was the State Board of Agriculture that provided the focal point for the activities which resulted in the passage of the Cannon Act of 1870 which provided the "charter" of the College.\(^1\) Much of the initial indifference on the part of many was due to the assumption that the Morrill Act provided only for a restricted sort of education. Eventually some people began to see the possibility of a complete and comprehensive university emerging. An extensive public debate took place between those who felt the institution should merely train farmers and mechanics in the specific duties of their vocations and those who supported a broader, more liberal education.\(^2\)

A number of attempts were made in the state legislature to create a university under the land grant endowment, but these were

---

\(^1\) Cope, Alexis., The History of the Ohio State University, Ed. by Thomas C. Mendenhall, (Columbus, Ohio: The Ohio State University Press, 1920), I, p. 6.

\(^2\) Ibid., p. 7.
defeated. The question of the scope of the institution was left in the hands of the board. Ultimately, the "liberals" won by a close vote of 8 to 7. On January 6, 1871 a committee of the Board of Trustees submitted a report which listed the departments which it felt should serve as a basis for the organization of the Ohio Agricultural and Mechanical College. The fourth department listed was the Department of General and Applied Chemistry.

More than a year elapsed until the Board established the professorship in General and Applied Chemistry. The description of the Department shows that even though the more "liberal" element had won, the purpose of the institution and the Department of General and Applied Chemistry was envisaged by their founders to be very practical.

General and Applied Chemistry, by which those of our pupils intending to pursue farming will be enabled to analyze their soils, the grains and crops they grow, the rocks, coals or minerals on their premises, and determine the value of peat, marl, animal, mineral or vegetable manures, and their adaptability to their own purposes; and to qualify others for useful and prominent positions in the numerous and varied pursuits of practical life which depend upon a knowledge of this important science.

---

3Ibid., p. 9.

4Board of Trustees of the Ohio Agricultural and Mechanical College, Annual Reports of the Board of Trustees, 1870-1877, First Annual Report, 1870-72, (Columbus, Ohio: Nevis and Meyers, State Printers, 1877), p. 71.

5Ibid., Second Annual Report of the Secretary of the Board of Trustees, 1872-73, p. 4.
J. Sullivant, Secretary of the Board, pointed out at the time that the "leading object" of nine of the ten professorships established was directly connected with agriculture and the mechanic arts, "which are liberally provided for". This concern for the pragmatic undoubtedly reflected both the concern of the National grant and the temper of the times. Professor Edward Orton in his inaugural address on January 8, 1874, spoke of the subject of chemistry as follows:

Chemistry has practical applications without number. It teaches the farmer the composition of the soil, the causes of its exhaustion, the laws of its renewal. The manufacture of iron and steel, of glass and soap and paint, are all chemical processes, and for attaining the best results in any of these processes, a knowledge of chemistry is indispensable.7

On January 2, 1873, the Board voted the elect Sidney S. Norton of Cincinnati to the Chair of General, Applied and Analytical Chemistry.8

Sidney Agustus Norton was born in Bloomfield, Trumbull County, Ohio, on January 11, 1835. He attended Western Reserve College at Hudson, Ohio, in 1852 and transferred to Union College in Schenectady, New York, in 1853. He graduated from Union College in 1856 where he ranked first in a class of ninety. In 1859 he received the A.M. degree.

6Ibid., p. 6.
7Board of Trustees, Third Annual Report, 1873-74, p. 16.
8Board of Trustees, Second Annual Report, 1872-73, p. 30.
In 1869 he received the degree of M.D. *in cursu* from Miami Medical College of Cincinnati and also in that same year an M.D. *in honore* from Western Reserve. He received the honorary degree of LL.D. from Wooster in 1881 and from Union College in 1899. In 1868 he went to Europe where he studied for sixteen months in the field of chemistry under Engelbach in Bonn, Kolbe in Leipzig, and Bunsen in Heidelberg. Norton began his teaching career at the Bartlett School in Poughkeepsie, New York. In 1858 he was made principal of the high school in Hamilton, Ohio and in 1859 he became instructor in Natural Science in the High School of Cleveland. Eighteen sixty-seven saw him return to Cincinnati as instructor in Natural Science at the Mount Auburn Young Ladies Seminary. The following year he became Professor of Chemistry in the Miami Medical College where he remained, except for his sixteen months in Germany and a year as Acting Professor of Physics at Union College, until he accepted the position at the Ohio Agricultural and Mechanical College.9

9Cope, *The History of the Ohio State University*, I, p. 66-67. McPherson, William, "The History of the Department of Chemistry of the Ohio State University," *Journal of Chemical Education*, VIII, pp. 640-641. The University Faculty of The Ohio State University, "Faculty Records, 1917-18, (Columbus, Ohio, 1918), pp. 26-27. The Board of Trustees of the Ohio State University, *Forty-ninth Annual Report of the Board of Trustees of the Ohio State University to the Governor of the State of Ohio*, (Columbus, Ohio); Hereafter the Annual Reports of the Board of Trustees will be referred to in an abbreviated manner, for example: Board of Trustees, *Forty-ninth Annual Report*, 1918-19, pp. 4-5.
On September 17, 1873 the College opened its doors. There were six professors, the president, and about twenty-five students, five of whom enrolled for chemistry. Two chemistry courses were offered, the General Course and the Special Course. The General Course extended through one year and the instruction was given mainly by recitations and lectures. The first term covered inorganic chemistry, the second term organic chemistry, and the third term was concerned with the application of chemistry to the arts. The Special Course extended through three years and included the recitations of the General Course along with work in the laboratory. The first year was devoted to the recitations of the General Course. In the second year the first term was concerned with qualitative analysis, including blow-pipe and flame analysis; the second term completed the qualitative analysis and began quantitative chemistry; and the third term was the completion of the quantitative work. The third year was engaged in laboratory work in which each student was permitted to select some special work such as the analysis of "substances pertaining to agriculture, to pharmacy, to manufactures, etc., or to pursue such special studies as may be directed by the professor".  

**Early Organization**

The early organization of the College grouped several departments into schools; the School of Exact Sciences, Natural History, and

---

Languages and Literature. Chemistry was in the School of Exact Sciences. Three degrees were offered, the bachelor of arts, the bachelor of science, and a degree in civil engineering. A two-year preliminary course was required for all degrees. During the first year, the courses required were:

First Term  Physical Geography  English  Algebra
Second Term  Physiology  English  Geometry
Third Term  Physics  English  Algebra

During the second year the required courses were:

First Term  Physics  History  Chemistry  Zoology
Second Term  Physics  History  Chemistry  Economics
Third Term  Botany  History  Chemistry  English  Trigonometry

Each department organized a two-year course of studies with daily recitations or lectures. Six of these two-year courses of study were required for each and all degrees, with at least one from each school. In the study for the degree, the remaining courses were to be distributed as follows:

B.A.: Three extra courses from the School of Language and Literature

B.S.: Three extra courses from the School of Exact Sciences or Natural History
Civil Engineering: Three extra courses from the School of Exact Sciences.11

When the College opened its doors it was housed in a single building and Chemistry occupied an "unpretentious" set of rooms on the third floor.12 Initially the building was not complete and a large part of the laboratory equipment which had been ordered from Europe had not arrived. The situation was described as follows:

In the laboratory subjects, chemistry, physics and mechanics, there was a lack of many things now regarded as absolutely essential to the simplest equipment. "Alcohol lamps were used in the chemical laboratory". Gas was not available initially.13

This is in some contrast to the report of T. Sullivant who described the conditions at the same time as follows:

The departments of Physics and Mechanics, of Chemistry (general and analytical), although not yet completed, are already well-equipped with apparatus and all the best appliances for teaching these branches, and our students have uncommon facilities for acquiring not merely a verbal and theoretic acquaintance, but a thorough and practical knowledge, in the working laboratories attached-advantages not attainable at present elsewhere in the State.14

11 The Ohio Agricultural and Mechanical College Faculty, "Faculty Records, 1873-1882", (Columbus, Ohio), p. 24. Hereafter the Faculty Records will be referred to in an abbreviated manner using the following form: College Faculty, "Faculty Records, 1873-1882", p. 24 or University Faculty, "Faculty Records, 1883-84", p. 53.


13 Cope, History of the University, p. 16.

14 Board of Trustees, Third Annual Report, 1873-74, p. 7.
The Chemistry Department was further described in the Board Report as being "supplied with the most approved facilities for illustration and research, and the methods of teaching employed are in the highest degree practical and thorough".  

The Chemistry Department report of November 17, 1874 gives perhaps a better indication of the situation which prevailed. Norton complained of the lack of various odds and ends and conveniences and requested $25.00 to meet these minor expenses. He pointed to a need for specimens illustrating a Natural History of the elements; the uses to which they and their compounds are put; various products illustrating the place of chemistry in arts and manufactures. He recommended the purchase of a suite of minerals "like August Krantz's for $100.00". Norton felt that the Department was well-provided for in qualitative analysis but did not feel well-supplied in quantitative analysis. He pointed out the need for a variety of items: a large sand bath and hood, steam bath and hood, a hood for poisonous gases, a drying case, bunsen's pump, and fixtures for the balance room and the spectroscopic closet.  

By 1875 the picture had improved with the provision of more equipment:  

---

15Ibid., p. 48.  
16Board of Trustees, Fourth Annual Report, 1874-75, p. 677.
II. Chemistry: In the line of studies for which the national grant aims to provide chemistry demands an equally prominent place with the department already named, and ample facilities are furnished for its study in the equipment of the College. A well-arranged laboratory, supplied with the best appliances for practical work, has been provided at large expense. In addition to this, the College has come into possession, by act of the legislature, of the valuable apparatus used by the chemistry department of the recently completed State Geological Survey. It, therefore, possesses everything requisite for the most thorough examination of coals, ores, clays, cements, limestones, and soils, and also for gas and water analysis.

The course in Analytical Chemistry provides full instructions in all departments of the science. In connection with the ordinary work of Quantitative Chemistry, the student is taught the use of the spectroscope and of the blow-pipe in Determinative Minerology.

The course in Quantitative Chemistry includes both the volumetric and gravimetric methods. The student will also be assisted in any special branch of the science that he may desire, and take up in detail topics which relate in Pharmacy, Medicine, Agriculture, and other sciences in which the principles of chemistry are applied.

Superior advantages are offered to the student in Theoretical and Applied Chemistry: A lecture-room furnished with all needful appliances and apparatus for illustration, has been begun. The aim is to collect in this museum all available material for the illustration of lectures upon the application of chemistry to the arts and to manufactures, and in this work considerable progress has been made.17

17 Board of Trustees, Fifth Annual Report, 1875-76, pp. 67-75.
The Philosophy and Methods of Norton

In the Department of Chemistry Report of 1876, Norton described his methods of teaching:

All of our students who work to obtain a degree are required to study chemistry for one year. This year, which is also the first year of the three year course, the pupil devotes to the study of general chemistry. In the class the textbook is followed, but not too closely.

It is a matter of constant endeavor to bring the subject home to the pupil. The various themes, as they arise, are first studied in the textbook and such other works as the student has at his command. He is then required to make out for the most important topics written exercises, in which a carefully methodized order is followed. Topics, too briefly considered in the textbook or difficult of comprehension, are taken up and elucidated by lectures. Most of these lectures are accompanied by a written syllabus, which the student has at his disposal for reference, and which he is allowed to copy. Three or four of these abstracts he is required to copy, and almost to memorize. These contain a summary of chemical philosophy. The blackboard is in constant use, both for synopsis of shorter topics and for the frequent recitations that occur in the course of experiment. Most of the students also take notes upon the lectures. The lectures and the textbook are illustrated by a very complete suite of experiments.

It is never forgotten that the lectures and the study of the textbook must be continually enforced by recitation and examination. The earnest attempt is made to bring the subject before the student in its logical sequence. The facts and theories of chemical philosophy are presented, explained, dwelt upon, and reviewed, as far as is thought necessary, for a complete mastery of that portion of chemistry which has been selected for study. The pupil is taught to think upon the various affinities and relationships of the elements and their compounds has his knowledge tested by stoichiometrical problems and learns the most important applications of each substance in the arts and manufactures.
At the close of this year the student, if he is competent to pass his examination, enters the laboratory. He has learned the theory and the underlying facts of chemistry, and can use intelligently the materials which are placed at his disposal.

Norton continued with his report describing the methods used in the laboratories. His training was very thorough. He expressed regret that more time was not available for the study of quantitative analysis and states that everyone who studies chemistry recognizes "the fact that there is practically no limit to the time which is required for a complete mastery of this ever-growing science."^18

Norton also included in this report samples of his examinations. The examinations in the General Course were subjective and consisted of about fifteen questions. The questions were quite descriptive in nature. The examinations in the Course in Analytical Chemistry consisted of detection of unknown substances. Many of the questions involved application to other fields of study and indicated to some extent Norton's rather broad training.

By 1875 the number of students in chemistry had increased to twenty-eight, twenty-two in general chemistry and six in analytical chemistry. Norton requested that the Board appropriate $75.00 to start a small library consisting of Watt's *Dictionary of Chemistry*.^19 Although the institution was small the need for more

---

^18 Board of Trustees, *Sixth Annual Report, 1876-77*, p. 71.

^19 Board of Trustees, *Fifth Annual Report, 1875-76*, p. 66.
administrative structure was beginning. Up to this point the faculty had scheduled course hours on an informal basis, but it was now found necessary to modify the permanent programs for recitations so that the "required courses" be "set at the morning hours".\textsuperscript{20} The chemistry report of that year listed the textbooks used in the courses:

- Bloxam's \textbf{Chemistry}
- Fowne's \textbf{Chemistry}
- Galloway's \textbf{Qualitative Chemistry}
- Willis \textbf{Qualitative Chemistry}
- Fresenius' \textbf{Quantitative Chemistry}
- Caldwell's \textbf{Agricultural Chemistry}

Bloxam's \textbf{Chemistry} was the primary textbook used in the General Course. The following year the number of students at the institution reached 120, with an enrollment of 31 in general chemistry and 9 in analytical chemistry. Norton's report that year contained continued references to the application of chemistry to common life and the arts.\textsuperscript{21} The nature of the Board was perhaps considered in this emphasis, but his examination questions do indicate a concern with the broader applications of chemistry.

The year 1877-78 saw a large jump in the enrollment as the institution topped 200 students. The chemistry enrollment doubled

\textsuperscript{20}Ibid., p. 75.
\textsuperscript{21}Board of Trustees, \textit{Sixth Annual Report, 1876-77}, p. 71.
to 61 in the General Course and 17 in the Analytical Course; 7 students were reported to be ready for the course in Quantitative Analysis. Norton's course of study remained essentially the same except that he "increased the number of studies" on topics in general chemistry and employed the advanced students in making a larger number of preparations than he had previously done.\(^{22}\) The number of reference books was substantially increased and included the original Watt's Dictionary of Chemistry along with Gmelin's Handbook of Chemistry; Wagner's Chemical Technology; Graham-Otto's Chemie; Rose's Analytischen Chemie; Gouy's-Besanes' Physiological Chemie; and Elderhorst's Determinative Minerology.\(^{23}\)

The Board established a Department of Mining and Metallurgy which required chemistry as prerequisite. This was followed in subsequent years with a significant broadening in the number of departments and in the offerings of the institution. One board action of 1877 that met with great faculty resistance was the dropping of the algebra requirement for entrance. This was probably an attempt on the part of the Board to increase the number of students at the institution. The conditions in the high schools, especially in the rural areas, was such that many students could not meet this entrance requirement. This action resulted in 20 students who formerly would

\(^{22}\) Board of Trustees, Seventh Annual Report, 1877-78, p. 22.

\(^{23}\) Ibid., p. 45.
not have qualified being admitted. The President immediately requested that the Board reinstate algebra as an admission requirement.\textsuperscript{24} The lowering of this admission requirement had an apparent effect on the performance of the students in the General Course in chemistry. In 1876 Norton praised the work of the students in the General Course: "Very many of the class in General Chemistry acquitted themselves with high credit, and the entire class is deserving praise for diligence and universal good behavior. The work done by the qualitative students is also commended, but I am not fully satisfied with the work accomplished by most of the quantitative students".\textsuperscript{25}

However in his report of 1879, which included those students who did not meet the algebra requirement he noted that of the sixty-five students who originally enrolled in the General Course in chemistry only twenty-four passed and twenty were repeating. The remainder had left.\textsuperscript{26} Whether this was solely due to the poor preparation of the students is not definitely established but at the insistence of the faculty, the Board reinstated algebra as an admission requirement. However, at the same time, in a rather unusual move, they reduced the salaries of the faculty by ten percent.\textsuperscript{27} This reduced the original salary of $2500 to $2250.\textsuperscript{28}

\textsuperscript{24}Ibid., p. 15.
\textsuperscript{25}Board of Trustees, \textit{Sixth Annual Report}, 1875-76, pp. 70-76.
\textsuperscript{26}Board of Trustees, \textit{Ninth Annual Report}, 1879-80, p. 25.
\textsuperscript{27}Board of Trustees, \textit{Eighth Annual Report}, 1878-79, p. 100.
\textsuperscript{28}Board of Trustees, \textit{First Annual Report}, 1870-72, p. 84.
This reduction was to remain in effect until the average attendance of students was over 200. The reduction remained in effect, however, for many years after the enrollment reached that figure and became a major problem in the recruitment and retention of qualified faculty members.  

The year 1878-79 saw some changes in the curriculum which effected the chemistry program. New courses being offered by the institution began to take their places in the required curriculum.

1. United States History was substituted for Zoology in the third term of the first year of the required course.

2. General History and Minerology were substituted for Physics and Chemistry respectively in the third term of the second year.

3. Laboratory Physics was struck from the third and fourth years of the Mining Engineering Course to devote time to Mining and Metallurgy laboratory work.

4. Second year Geology was replaced by Mechanical Engineering.

5. Second year English was substituted for Botany in the course of Mechanical Engineering.

6. In adopting a degree of Mechanical Engineering, Metallurgy was substituted for Chemistry in the final adopted course.

---

29 Cope, The History of The Ohio State University, I, p. 50.
7. For the B.S. and B.A. degrees, the selection in the School of Exact Sciences was limited to Mathematics, Physics, and Chemistry.

8. For the B.S. and B.A., the selection from the School of Natural History was limited to Botany, Zoology, and Geology.

9. The number of studies was limited to four full studies for each student except by a special note of the faculty.

Norton, in his report of departmental activities for that year, included comments on the effect of the decrease in the time allotted to General Chemistry by the new measures:

The course of study in General Chemistry taken by the last class extended through the entire year, with a weekly average of more than 4\(\frac{1}{2}\) recitations. Owing to a change in the required course of study, the present class will have daily recitations extending through the first two terms of the year, or for 26 weeks. By reason of this change in the time assigned to General Chemistry, I shall be compelled to omit some of the details heretofore presented, but shall endeavor to give the class a well-ordered outline of the science. I shall follow, as far as possible, the mode of teaching described in my fourth annual report. (NOTE: this is his sixth annual report). The course of study in analytical chemistry extends, for each student, over two years time, in which he is expected to average two and one-half hours daily work. Each student works independently and advances in his study as fast as his ability

\[30\text{College Faculty, "Faculty Records, 1873-1882", p. 165-172.}\]
and his diligence warrant. After the first few weeks of the year, there are almost as many classes in the laboratory as there are students, but I find it profitable to them, as well as convenient to myself, to have them work as far as possible in small groups.31

At this time, Norton made a change in the principal textbook used in General Chemistry, replacing Bloxam's Chemistry with his own book, Norton's Chemistry.32 Bloxam's textbook was published in 1854 and was the effort of two English chemists. It was a synopsis of their experience in laboratory teaching. It contained instruction in laboratory techniques, a concise overview of general chemistry as it applied to the laboratory, and sections on qualitative and quantitative analysis. The plan of instruction was similar to the one introduced by Liebig, but modified for the English student. The authors stated that they intended to enter "into theoretical considerations" only so far as was absolutely necessary.33

Norton's Chemistry, published in 1878, had been preceded by another effort, Norton's Natural Philosophy. This book was the result of the author's experience teaching physics. In the preface, Norton reveals something of his philosophy of teaching. He stated:

While due attention has been given to the recent progress in Physics, including the latest methods and inventions, it has not been forgotten that all facts are equally fresh to the tyro,

31 Board of Trustees, Eighth Annual Report, 1878-79, p. 19.
32 Ibid., p. 51.
although all are not of equal importance, either as regards their fitness for developing the theory of the science, or their application to the practical affairs of life. For this reason nothing has been introduced for the sake of its novelty; nor have cardinal principles been omitted, because a former generation of pupils studied them....

It has been an object of careful thought to present the science in all its departments, in a manner at once systematic and symmetrical. Of course, no pretense is made of exhausting the subject, but it is hoped that the student will find in the treatise all that is necessary for his purposes. While fully impressed that 'there is no royal road to science', the author has yet endeavored to make the labor of the student as attractive and invigorating as possible. To this end, the subject has been treated not merely as a science to be learned, but also as a means of educational discipline: the topics are considered in their logical order, methodically developed, thoroughly illustrated and enforced....

No pains have been spared to secure clearness of expression, precision in definitions and accuracy of the statement of facts.34

An examination of Norton's *Chemistry* indicates the author made every effort for a concise, clear expression of his thoughts. The presentation is well-ordered, logical, and reinforced. The first three chapters concern themselves with general principles and background. The remainder of the book deals with the various groups of elements and their compounds, along with a chapter on ceramics and glass, crystallography, and a section of problems. Each chapter is subdivided into short, readable sections, interspersed at

appropriate places with experiments which were to be performed by
the instructor to illustrate the topic. At the end of each chapter
there was a "Recapitulation", which reviewed in outline form the
discussion of the chapter. It was, all in all, a very systematic,
well-designed textbook. It differed somewhat from Bloxam's Chemistry
in that it was a textbook rather than a glorified reference book.

In 1884, a second edition of Norton's book was produced. The
only difference was the addition of close to 200 pages concerned
with organic chemistry. In the preface to this second edition, he
advises his fellow teachers "not to attempt to put theory above
practice." He contended that "the use of theory is to enable one
to generalize known facts and predict new ones; the business of teaching
is to enable the student to master facts, principles and laws already
ascertained and established".35

The limiting of General Chemistry to two terms was too short to
suit Norton. On October 23, 1879, a committee was formed on the
revision of courses with Norton and Professor Tuttle as members.
Under the new curriculum, General Chemistry was moved to the first
year of the B.A., B.Phil., and B.S. programs in the General Course.
It was also required in the first year of the technical courses.
A bachelor of agriculture degree was created and chemistry was made
a requirement of the first year.36 At the same time, Norton's complaint

35 Norton, Sidney A., The Elements of Chemistry: Inorganic and

36 College Faculty, "Faculty Records, 1873-1882", p. 207.
that two terms was too short was partially met by provision for
and additional two-fifths of a term to be devoted to General
Chemistry.

In 1879 in his report of the Chemistry Department, Norton
reported that his students attended voluntary classes and gave
some more insights into his teaching methods and philosophy:

During a portion of the last summer term,
a respectable number of the class attended a
voluntary course of lectures with me, on topics
connected with organic and applied chemistry.
The work in this class of General Chemistry is
done by lectures mainly. Lessons are, however,
assigned daily in a textbook, and the progress
of the students tested, partly by oral ques-
tions, and partly by frequent written examin-
ations.... As regards the business of teaching
chemistry, experience has shown me that
analytical students are prone to rest satisfied
with the mechanical process of analysis if only
certain results are attained, and to neglect
the principles and facts upon which true science
is founded. I have always endeavored to counter-
act this tendency by making General Chemistry
an indispensable introduction to the laboratory,
and by urging and requiring, as far as I can,
frequent reviews of the larger textbooks. I
am now more than ever persuaded that Synthetical
Chemistry demands a larger place in the teaching
of chemistry than is usually given. I have,
hitherto, given our students as much work as I
could in this direction, and have generally had
enough for them in the bye-products of experi-
ment and in the preparations needed for the
laboratory. Now, that our classes have become
so large, it will be necessary to provide
specially for it by the purchase of a stock of
crude material. No work in chemistry is more
delightful to the young chemist, than the making
of preparations, and it cannot be left out of a
complete course of instruction in the science.
It's proper place, in the first year's work, is to relieve the monotony of the daily routine, and to serve as a basis for reviews. In the second year, it may go hand in hand with the analytical work, without greatly interfering with the work of analysis.37

During the first years, Norton had no help, except that volunteered by some of his students, to whom it was considered a privilege to be able to assist him in the preparation of his experiments.38 The increase in the number of students made greater demands upon Norton and led to the hiring of a student assistant, David O'Brine.39 He had full charge of laboratory accounts and many other details of the laboratory.40 Eventually, he would teach several of the courses. In 1887 he resigned to accept the position of Professor of Agricultural Chemistry at the University of Colorado.41

Norton's need for chemicals in the synthetic work was met in 1881 when the Board appropriated $300 to the Chemistry Department for chemicals and $200 for student help.

In 1880 there was a decrease in the number of students enrolled in General Chemistry from 65 in the Fall of 1879, to only 52 during

37 Board of Trustees, Ninth Annual Report, 1879-80, pp. 25-27.
38 McPherson, "The History of the Department of Chemistry," VIII, p. 64.
40 Board of Trustees, Tenth Annual Report, 1880-81, p. 22.
41 Board of Trustees, Seventeenth Annual Report, 1887-88, p. 16.
the Fall of 1880. Norton attributed this to the decrease in the number of electives available to the student. He stated that the "falling off in numbers is due to the more rigid classification of our students, which has been adopted in place of a large choice of elective studies." It might also be stated that new departments were finding their way into the required curricula.

At this time, the expansion of the number of laboratory courses offered and the increase in the number of students resulted in a variety of scheduling problems. On February 17, 1881 a committee was formed to examine the question of laboratory hours. On September 16, 1881 the committee suggested a systematic schedule of laboratory hours. This proposed schedule did not suit Norton and his method of teaching and he requested and received extended hours for the Chemistry Laboratory. The Norton method of small group instruction, with each proceeding at his own pace, probably required a more flexible, open type of laboratory schedule. The Chemistry Laboratory was open every morning and Monday, Wednesday and Friday afternoons. It might also be noted that with the reinstatement of the algebra requirement a greater proportion of the students in general chemistry successfully completed the course.

42Board of Trustees, Tenth Annual Report, 1880-81, p. 22.
43College Faculty, "Faculty Records, 1873-82", pp. 296-99.
In his report of 1881, Norton called for some action to expand the work in chemistry. He suggested a degree in Analytical Chemistry, a theme which he proposed unsuccessfully on a number of occasions. He suggested that the degree "might attract students who are looking to future work in iron works and other establishments requiring chemical knowledge". He called on the University to expand into areas of special educational needs stating that he was "persuaded that it is for the welfare of the University to offer as many special courses as our facilities for instruction warrant. They may be regarded as so many different apprenticeships for future work of some sort, and will tend to prepare such students to make headway in the coming struggle of life. It is out of place here to estimate the so-called educational value of such special, and thereby one-sided courses. It may be granted that they do not fall into any theory of educational training; but such specialities are needed."

Norton also proposed that if an Assistant Professor of Agricultural Chemistry were appointed that he be put in charge of all that which related to organic chemistry. Norton felt that he was doing less in organic chemistry than should be done because the students were not retained long enough to do much in that branch of the science.

---

44 Board of Trustees, Eleventh Annual Report, 1881-82, p. 23.
45 College Faculty, "Faculty Records, 1873-82", p. 23.
The money required to maintain the program in chemistry was not great, although it was undoubtedly larger than most other departments. The appropriations for 1882 which show a substantial increase over prior years were as follows: 47  

<table>
<thead>
<tr>
<th></th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical library</td>
<td>$100.00</td>
</tr>
<tr>
<td>Purchase chemicals</td>
<td>500.00</td>
</tr>
<tr>
<td>Chemical lab supplies</td>
<td>300.00</td>
</tr>
<tr>
<td>Assistant in chemistry</td>
<td>150.00</td>
</tr>
</tbody>
</table>

The expansion of the University, had, however, led to crowded conditions in the chemistry laboratories. As early as 1879 President had reported to the Board that "the truth is, the Chemical Department needs a building to itself, and it is to be hoped that its necessities can soon be met". 48 In 1881, the Secretary of the Board, Albert Allen, pressed the need for a chemistry hall stating it to be the "most pressing want". 49 Not only would the increased enrollment warrant a new building for chemistry but one can imagine there must have been some misgivings about having these activities occurring in the main building.

The structure was ready for occupancy in September of 1882. The building was built in the form of a "T," the front measuring 160 feet and the center 80 feet in depth. The building was two stories high with the second floor assigned to the Department of Chemistry.

---

47 Ibid., p. 91.
48 Board of Trustees, Ninth Annual Report, 1879-80, p. 19.
49 Board of Trustees, Eleventh Annual Report, 1881-82, p. 13.
and the lower story to Mining and Metallurgy, and later also Agricultural Chemistry. The chemistry floor is described in detail.

The laboratory of General and Applied Chemistry is modeled after the great laboratory of Leipzig. There is a fine lectureroom, well lighted from the east and west sides, 40 feet square, with a high ceiling. The seats for students are raised in tiers, affording a clear view of the lecture table. Back of this table is the preparation room. At one end of the table is a balcony arranged under the open sky for exceptionally offensive reactions. The walls of the lecture room will contain cases of specimens illustrative of lectures, together with diagrams and charts, setting forth the ascertained facts and principles of Chemistry.

The west wing of the upper story is devoted to qualitative analysis. It contains a large room, lighted on both sides, fitted with six special hoods, a large steam hood, three large poison hoods, and accommodations for thirty students at a time. Adjoining this laboratory are two rooms of general utility, one assigned to those operations in which poisonous or unpleasant gases are evolved, the other to large operations requiring the use of the forge, the blowpipe, the workman's bench, etc.

The east wing of this story is devoted to quantitative analysis. It has accommodations for sixteen students at a time, and is provided with the accessories of hoods before described. At the extreme end of the wing are four rooms assigned to (1) balances, (2) reference books, (3) gas analysis, (4) combustions, besides a closet for spectroscopic work.

Both of these analytical laboratories are constructed with reference to the best possible ventilation. Accordingly, each laboratory in
addition to its hoods, has four nine-inch flues that must remain open whatever may be the theories or practices of the janitor. It has also, subject to the janitor, an opening extending the whole length of the ceiling and open to the sky. It has a transom for each window, opening inwards, easily controlled, while all the windows are so constructed that while all the windows can be thrown entirely open at once, whenever it may be desired to fill the laboratory speedily with fresh air. It is hoped that these devices will accomplish the all-important work of ventilation without requiring a very large expenditure of heat.

Besides the lecture-room and laboratories thus described, there are several other rooms in this upper story -- (1) the private laboratory of the Professor, (2) a working-room for his assistant, (3) store-room, (4) distillation-room.

The space needed to light up the hall will have on both walls cases containing specimens illustrative of Industrial Chemistry, always open to inspection.

The structure was ready just in time because in 1882 there was a substantial increase in enrollment in the chemistry courses, from sixty-five to eighty-eight in General Chemistry and from twenty-three to twenty-eight in Analytical Chemistry. The university itself experienced substantial growth that year with the enrollment increasing from 280 to over 350. President Scott was forced to press the Board for more instructors. David O'Brine continued as the assistant in chemistry and aided in the instructional effort by giving a course of lectures on analytical operation to a good-sized class of voluntary students.

---


51 College Faculty, "Faculty Records, 1873-82", p. 344.
A New University Organization

This expansion in enrollment and the new offerings of the institution led to the need for a new organization for the University. Four schools were established: the School of Agriculture, the School of Arts and Philosophy, the School of Science, and a School of Engineering. Each of these schools had a standing committee and a secretary. Chemistry was included in both the School of Arts and Philosophy and the School of Science, thus Norton was a member of both committees, although he was not too active in committee work. The Schools offered the following degrees:

School of Agriculture
B. Agr.

School of Arts and Philosophy
B.A. and B.Phil.

School of Science
B.S.

School of Engineering
Degree in Civil, Mechanical, and Mining Engineering

At this time, chemistry was dropped as a requirement in the Civil Engineering curriculum. Basically, however, the role of chemistry remained the same. It was required in the first year of the B.A., B.Phil., and B.Agr. programs. In the B.S. program the student elected an advanced course from the branches started in the first year. The selection was confined to botany, chemistry, physics,

---

52 College Faculty, "Faculty Records, 1873-82", p. 344.

53 Board of Trustees, Twelfth Annual Report, 1882-83, pp. 21 and 65.
mathematics, anatomy and physiology. In the junior year the electives were extended by the addition of vertebrate anatomy and physiology. In the senior year they were extended by paleontology and philosophy and ethics. In both the B.A. and B.Phil. programs a student could select any other science which he had the elements of in his senior year.\textsuperscript{54}

Norton, always eager to expand the time devoted to chemistry, asked that the morning students in chemistry laboratory have two hours of daily work. This was adopted by the faculty on September 18, 1883.\textsuperscript{55} This was designed to expand the time devoted to chemistry by those who wished to specialize in the subject. Norton indicated that this would allow students to "double time" and take five years nominal work. He felt that this would be "sufficient time to enable any diligent student to reach a fair degree of attainment in practical chemistry, and, taken in connection with allied studies, fit him for the work of 'chemical engineer'."\textsuperscript{56}

In July of 1883 the Trustees formally established the Chair of Agricultural Chemistry and appointed Professor H. A. Weber of the Industrial University in Champaign, Illinois to this position.\textsuperscript{57} This probably pleased Norton as he had suggested a faculty member

\begin{itemize}
\item[\textsuperscript{54}] Board of Trustees, \textit{Thirteenth Annual Report, 1883-84}, p. 51.
\item[\textsuperscript{55}] University Faculty, "Faculty Records," 1883-84, p. 53.
\item[\textsuperscript{56}] Board of Trustees, \textit{Thirteenth Annual Report, 1883-84}, p. 36.
\item[\textsuperscript{57}] Board of Trustees, \textit{Fourteenth Annual Report, 1884-85}, p. 14.
\end{itemize}
in this area might take over the work in organic chemistry. Norton had referred to the position, however, as that of an assistant professor and perhaps he had envisaged agricultural chemistry as coming under the Department of Chemistry. Initially the equipment used in the new department was borrowed from the Chemistry Department. Some of the teaching burden was assumed by Weber when agricultural chemistry replaced chemistry as a required course in the first year of the Short Course in Agriculture.  

A recent act of the General Assembly had provided for a state board of pharmacy and Norton, who had supported special courses earlier, suggested a special course for pharmacists. That year David O'Brine conducted a voluntary course in Materia Medica and three of his students applied and passed their state board examinations in pharmacy. Norton had also suggested a course leading to a degree in Chemical Engineering but it was the area of pharmacy which was first developed. On September 16, 1885 the President and Professors Norton, Townshend, and Weber were appointed to arrange a course in pharmacy. The School of Pharmacy was established and Mr. George B. Kauffman was hired as a practical pharmacist to give lectures.

---

58 University Faculty, "Faculty Records, 1884-85", p. 118.
59 Board of Trustees, Fourteenth Annual Report, 1884-85, pp. 16 and 31.
60 University Faculty, "Faculty Records, 1885-86", p. 145.
In the Provisional Course in Pharmacy, chemistry was required in the first year, followed by chemistry laboratory in the second year. A Veterinary Science Course was also added and General Chemistry was required in the second year.\textsuperscript{61}

Norton's proclivity for expanding instruction outside of the regular schedule continued. He reported that he supplemented the individual instruction necessary in the laboratories by gathering students in classes for systematic instruction, review and drills, but that it was necessary to do most of the work "out of college hours". He stated that so much success was attained that the plan would be continued. He also noted that there was increasing difficulty in arranging laboratory hours. He commented that "although the number of students was less than in the year previous, the work of instruction was not less onerous, largely to the difficulty of arranging the laboratory hours as per college programme".\textsuperscript{62}

On November 11, 1885 a Committee on Electives was appointed to consider the question of electives in regard to the three general courses. On December 2, 1885 the committee resolved that in the senior year of the general course the electives that had been previously limited to science be expanded to include any course in the curriculum. This resolution was held for further consideration and after much discussion the Committee on February 3, 1886 stated that "they find

\begin{footnotes}
\item[61] Board of Trustees, \textit{Fifteenth Annual Report, 1885-86}, pp. 12, 137-138.
\item[62] Board of Trustees, \textit{Sixteenth Annual Report, 1886-87}, p. 31.
\end{footnotes}
that our University has fallen behind many of its sister colleges in the State in offering to the students a reasonable election of work; and they feel that the people and the students are entitled to demand that we keep abreast of the advancing spirit of education method". The Committee therein submitted two schemes of changes commenting that they were "aware it may be objectionable to some, but we have endeavored, regardless of personal feelings so to adjust the courses that each subject shall receive its due share of attention, which no one shall be assigned on one hand to obscurity or on the other hand to undue prominence." The proposals were discussed and the committee was expanded by the addition of two professors from the technical and scientific departments—Thomas and Lord. This perhaps indicated a dissatisfaction on the part of those areas of study. The question was resubmitted to the enlarged committee, now know as the Committee on the Revision of the General Courses, which reported on April 14, 1886. This report was extensively debated for six weeks and a number of amendments were offered and rejected. One of the rejected amendments was to add one hour to the first and third term of the General Chemistry Course in the freshman year in the Course in Arts and Philosophy. Finally on June 22, 1886 all changes were made in the General Course.
In the B.A. and B.Phil. programs four hours of chemistry were required in the first term, two hours in the second term, and four hours in the third term of the first year. In the second through the fourth year chemistry laboratory could be elected. In the B.S. program the chemistry portion was identical to the B.A. and B.Phil. programs. By October 6, 1886 the B.Agr. and the Graduate in Pharmacy programs were firmed up and made consistent with the General Course in the freshman year. In the Graduate in Pharmacy Course qualitative chemistry was required in the second year but dropped as a requirement in the last two terms of the third year. In the technical courses the freshman year was the same as the B.S. program. In Mining Engineering, analytical chemistry was taken in the second and third year. In the course in Veterinary Science, General Chemistry was taken in the second year. The work of the collegiate departments was reorganized into five schools designated as the Schools of Agriculture and Veterinary Medicine, Engineering, Science, Arts and Philosophy, and Pharmacy.

The new curriculum and organization gave increased recognition to the new areas of study at the University along with a greater place in the curriculum. The General Chemistry program was not substantially affected by these changes other than in a change in the hours for

63 University Faculty, "Faculty Records, 1886-87", pp. 157, 163, 176, 181, 185, 191, 205, 206.
64 Board of Trustees, Sixteenth Annual Report, 1886-87, p. 117.
65 University Faculty, "Faculty Records, 1886-87", p. 239.
the course. It was still a required course in the freshman year for most of the students.

The following year Dr. David O'Brine, who had served as Assistant in Chemistry for a number of years resigned and was replaced by Frederic Keffer, a graduate of the Ohio State University in 1882. His initial salary was $800 per year. Keffer, as O'Brine before, taught some of the smaller classes, such as the class in stoichiometry.

On the morning of February 12, 1889 the Chemical Laboratory Building was destroyed by fire. The fire was described by the President as the most notable event of the year.

It was discovered by the night watchman a few minutes after three o'clock. An alarm was given as soon as possible; but the hose wagons, having a long distance to run, were so late in arriving, and met with so much delay in making connection with the water pipes, that the flames had made great progress before anything was done to arrest them. Even then the pressure was for some time so feeble that but little effect was produced. In two hours the building and its contents were almost wholly destroyed.

The immediate effect of the disaster was the suspension of all the laboratory work that had been carried on in the building. Three departments were thus disabled--general chemistry, agricultural chemistry, and mining and metallurgy. Class work, however, was resumed almost without interruption in those rooms that could be spared for the purpose an hour or two each day. A spirit of accommodation

66 Board of Trustees, Seventeenth Annual Report, 1887-88, p. 16.
67 Board of Trustees, Eighteenth Annual Report, 1888-89, p. 38.
was shown on every hand. The departments of general chemistry and of mining and metallurgy were transferred to the main building, that of agricultural chemistry was provided for in the botanical building, while a lecture room for the veterinary department was generously offered by the agricultural experiment station. The legislature afforded prompt relief by an appropriation of five thousand dollars for the equipment of temporary laboratories. With the facilities thus secured we were soon able to resume the work of the laboratories. Yet, after all that could be done, these departments labor under serious disadvantages, and have also somewhat impeded the work of other departments.

But every drawback has been encountered cheerfully, and all have shown a disposition to make the best of the situation. This has been done the more easily from the fact that we have been able to look forward to an early deliverance. The appropriation of forty thousand dollars, made by the legislature, to replace the chemical building, has been so judiciously applied that we shall soon have accommodations much superior to those we have lost. The space will be ample for the present demands it is intended to supply; the arrangement will, in almost every respect, be convenient; and the appliances, so far as they are provided for, will surpass the former ones.

These appliances, however, are but a small part of what will be required. Indeed, they are only such as it was necessary to include in the construction of the building itself. The means to provide desks and other furniture, shelving, gas and water fittings, and considerable quantities of chemicals and glassware, are still to be procured. For these objects not less than twenty thousand dollars will be required.68

The following year the President reports that the notable event was the completion of the new chemical laboratory. He describes it

68 Board of Trustees, Nineteenth Annual Report, 1889-90, p. 29-30.
as having a better location, greater space, and more convenient and complete equipment which "places the institution in a position to accomplish far more in its chemical instruction than it could do before".  

By 1890 the enrollment in the various chemistry courses had increased to such a degree that the President reported: "Since the opening of the present year it has been found that the number of students in the laboratories of general chemistry and agricultural chemistry is so great as to make it necessary, in order to maintain the efficiency of instruction, to place an assistant in each of them".  

Mr. Clair A. Dye, a third year student in pharmacy, was hired as assistant in General Chemistry at a salary of $400. It was fortunate that he was hired because Norton experienced some ill health that year. He writes that, "For the last month of the second term, by permission of the Board of Trustees, I was absent in Florida in search of health, and with profit. The classes during this time were left entirely in charge of Mr. Keffer and Mr. Dye".  

At this time, the University experienced a major change in its financial picture. The General Assembly enacted an amendment to section 3951 of the revised status providing an annual tax levy

---

69 Board of Trustees, Twentieth Annual Report, 1890-91, p. 25.
70 Ibid., p. 27.
71 Board of Trustees, Twenty-First Annual Report, 1891-92, p. 65.
of one-twentieth of a mill for support of the University. The President stated that "the financial resources of the University have gained at one bound as much as they had reached in all its previous history. And this gain was intended to be permanent".\(^{72}\)

Meanwhile, the enrollment in the college level courses had been increasing rapidly, while that of the preparatory courses had been leveling off. This fact, plus the more comfortable economic situation led the President and faculty to push for the elimination of the preparatory program. The President in his report to the Board wrote that "it hardly seems justifiable for the University to furnish instruction in the studies preparatory to the general and engineering courses." He pointed out that "the room they occupy is greatly needed by the students of collegiate rank; and the money expended in teaching them would add much to the efficiency of the higher departments." "Besides all these points of advantage, the change would promote the dignity and standing of the University."\(^{73}\) Thus we see the institution beginning to strive toward greater status as a University and having enough security so that it could afford to drop its preparatory program. However it wasn't until 1895 that the program was discontinued.\(^{74}\)

\(^{72}\)Ibid., p. 29.

\(^{73}\)Ibid., p. 42.

\(^{74}\)Board of Trustees, Twenty-Sixth Annual Report, 1896-97, p. 27.
The Conflict Over Laboratory

As we have observed Norton was trained in the methods of the German universities and felt strongly that the first year course should consist of lectures and recitation, without laboratory practice. He held the position that only after the student had completed the general chemistry course and "learned the theory and the underlying facts of chemistry" was the student able to "use intelligently the materials which are placed at his disposal" in the laboratory.

This position was not in accord with the educational theories of many of the other faculty members. Earlier, in the catalog of the University it was stated: "Much of the work in science is performed in the laboratories by the students themselves. To promote this, which is now universally recognized as the true method of teaching science, the Trustees and Faculty have been at great expense and pains to provide the best possible facilities."

Finally this difference in opinion resulted in a crisis which resulted in Norton's removal in 1894 as head of the department. William McPherson, who replaced Norton later describes the situation that arose:

Other members of the instructional staff of the university, interested in the development of

76 Board of Trustees, Sixth Annual Report, 1876-77, p. 72.
77 Board of Trustees, Thirteenth Annual Report, 1883-84, p. 53.
the method of teaching chemistry, insisted that laboratory work was just as essential a part of the course in general chemistry as it was of the course in qualitative analysis. The feeling became so intense that Professor Weber finally withdrew all first year students in agriculture from the Department of Chemistry and provided for a separate course in the Department of Agricultural Chemistry, in which laboratory work was made an essential part. 78

The removal of the agricultural students from the Chemistry Department was soon followed by the removing of the engineering students from the General Chemistry Course. This left the General Chemistry Course with the students in science and pharmacy and as an elective for the students in arts and philosophy. 79 The students in agriculture, veterinary medicine, and engineering all took their first year of chemistry in the Department of Agricultural Chemistry. This resulted in a drastic change in the enrollment in the two departments.

TABLE 1

<table>
<thead>
<tr>
<th>Autumn Quarter</th>
<th>General Chemistry</th>
<th>Agricultural Chemistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1890-91</td>
<td>106</td>
<td>--</td>
</tr>
<tr>
<td>1891-92</td>
<td>86</td>
<td>119</td>
</tr>
<tr>
<td>1892-93</td>
<td>72</td>
<td>141</td>
</tr>
<tr>
<td>1893-94</td>
<td>64</td>
<td>121</td>
</tr>
<tr>
<td>1894-95</td>
<td>134</td>
<td>57</td>
</tr>
</tbody>
</table>

8Board of Trustees, Twenty-First Annual Report, 1891-92, p. 64; Twenty-Second Annual Report, 1892-93, p. 54; Twenty-Third Annual Report, 1894-95, pp. 46-47; Twenty-Fifth Annual Report, 1895-96, pp. 38-40.


79Board of Trustees, Twenty-First Annual Report, 1891-92, p. 53.
President Scott described the situation in the two departments as follows:

Last year for the first time the students in the engineering department studied chemistry under the Professor of Agricultural Chemistry. In the laboratory of this department there are but 54 desks. Last year there were for these 54 desks, 126 students; this year there are 144. For the work required of it at present there should be three times as much laboratory space as there is; and if provision were made for the probable growth of the next two years, five times as much space would be required. I look upon this as one of the most urgent of our present necessities. It is impossible to handle so large a body of students satisfactorily with accommodations so limited....

The transfer of the freshmen in the engineering courses to the department of agricultural chemistry has reduced the number in the department of general chemistry. The number of classes, however, remains as it was. The instruction is wider in its range and it is carried to a greater limit than in the department of agricultural chemistry. Facilities for advanced work, and such subjects as toxicology, stoichiometry and proximate organic analysis are not taught, not incidentally in a few lectures, but in classes formed for that purpose. Additional outfit is desired for special work.80

Norton was forced, against his better judgment, to introduce a limited amount of laboratory work in the elementary course.81

In 1892 Frederic Keffer had resigned and William McPherson, a graduate of the class of 1887 was named Assistant in General Chemistry at a salary of $1200.82 McPherson was apparently brought in to

---

80 Board of Trustees, Twenty-First Annual Report, 1891-92, p. 40.
82 Board of Trustees, Twenty-Second Annual Report, 1892-93, p. 107.
straighten out the situation in General Chemistry. Norton continued to lecture the elementary course but McPherson took over many of the other courses. In 1893 McPherson was promoted to assistant professor at $1500 per year. McPherson enjoyed the support and respect of President Scott who commented in one of his reports on "the very capable and zealous services of Assistant Professor McPherson are of value to his department". He also apparently got along well with Professor Weber for they jointly published a paper in the Journal of the American Chemical Society.

Meanwhile the crowding in Agricultural Chemistry had become more severe. It was necessary to accommodate more students by placing desks in the former store room of the department, in the room designed for organic analysis, and in the preparation room. Even with these measures each student shared his desk with another student. Professor Weber felt that his first duty was to the students in agriculture and on September 20, 1893 he asked to be relieved of the duty of providing instruction in introductory chemistry to the students in the engineering courses. His request was referred to the Engineering Committee along with himself and Professor Norton. On October 11, 1893 this special committee reported that the engineering students

83 Board of Trustees, Twenty-Third Annual Report, 1893-94, p. 31.
84 Board of Trustees, Twenty-Fourth Annual Report, 1894-95, pp. 30, 36.
85 Ibid., p. 36.
would remain in the Department of Agricultural Chemistry. Norton was apparently rather unyielding on his position but he was resisting an idea whose time had arrived. To make matters worse there was at this time an incident of cheating in elementary chemistry which was brought before the faculty in April of 1894. Apparently a student or group of students were involved in stealing questions from Norton's desk.

The following year Professor Weber again asked to be relieved of the task of providing instruction to the freshman engineering students. The question was again referred to a special committee composed of the Engineering Committee, Professors Weber and Norton. On October 10, 1894 the Secretary of the School of Engineering reported that the Committee recommended the transfer of all freshman engineering students except those in mining engineering to General Chemistry in the fall term. This report was adopted. This was only a temporary expedient, however, and Norton was under continuing pressure to introduce laboratory into his course.

A month later the Engineering Committee recommended that a new course in instruction in General Chemistry of two terms to replace Agricultural Chemistry in the freshman year of the engineering course be established, whose character would be the same as given by Professor Weber. The faculty adopted this report initially, but on

86 Board of Trustees, Twenty-Third Annual Report, 1893-94, pp. 39 and 42.
reconsideration referred it back to the Engineering Committee with the addition of Weber and Norton. In December the Secretary of the Engineering Committee reported back to the faculty that the special committee had voted to recommend that "Freshmen in all Engineering Courses except Mining Engineering, be assigned to General Chemistry (1) 2 and to special laboratory work of 3 hours in the Department of General Chemistry during the second term of 1894-95". This report was adopted by the Faculty.87

The introduction of laboratory in the second term and the return of the engineering students necessitated the hiring of Joseph C. Ritchey, B.S. as laboratory assistant.88

Norton's resistance to the introduction of laboratory undoubtedly was possibly responsible for the fact that in 1894 he was asked to resign as head of the Chemistry Department and made lecturer in General Chemistry.89 This resulted in his salary being cut in half. In writing of this event McPherson says that it was because of advancing age, however Norton was only 60 and he was able to continue to teach courses in the Department for a number of years and lived until August 30, 1918. In 1899 he was elected emeritus professor of general chemistry, but the election involved no change in

87 University Faculty, "Faculty Records, 1894-95", pp. 82, 88, and 91.

88 Board of Trustees, Twenty-Fifth Annual Report, 1895-96, p. 28.

89 Ibid., p. 29.

his duties as lecturer in General Chemistry.\textsuperscript{91}

Norton was unable to adapt to the new educational ideas. His methods of teaching were becoming unsuitable for a growing institution. The complexity of the institution required a greater interaction and cooperation between different units and Norton had always preferred spending his time working with small groups of students and avoiding if possible committee work. At the same time significant changes were occurring in the science which would result in greater specialization and an emphasis on investigation and research.

William McPherson was promoted to associate professor and given the charge of the department. He was a man greatly suited to the new demands of the institution and the science.

\textsuperscript{91}Board of Trustees, \textit{Thirtieth Annual Report, 1900-01}, p. 30.
CHAPTER III

THE McPHERSON-HENDERSON YEARS

Expansion of the Department

The teaching philosophy of William McPherson differed significantly from that of Sidney Norton. This philosophy in its time, along with the man himself, proved to be eminently suited to the needs of the Department and the University. McPherson put great emphasis on the student developing his own abilities of study and he encouraged less dependence on the lecturer and lectures and greater dependence on the use of textbooks, reference materials and laboratory instruction.

He sat with the faculty for the first time on October 9, 1895. He lost no time in moving for modification of the chemistry program which would make it consistent with his own views and those of the other faculty members who favored laboratory in the elementary course. At that first meeting he gave notice of a motion to abolish the existing courses in General Chemistry and to substitute certain others in their stead. At the next meeting his motion was adopted. Laboratory was established as an integral part of the elementary chemistry course as a result of these actions.

1The University Faculty of the Ohio State University, "Faculty Records, 1895-96", (The Ohio State University Archives), p. 123, 127 and 128.
McPherson was active in committee work and was instrumental in many of the changes that were to take place in the institution in the years to follow. The year 1896 seems to represent the start of a more conscious effort to establish Ohio State as a true university. Early in the year the faculty took steps to abandon the preparatory program so that its resources could be better spent on the college level work. The dropping of the preparatory program has been pushed for since 1890. In 1891 President Scott argued for the elimination of the preparatory program by pointing to the increasing competition with other institutions to provide new programs, new methods, and new facilities at the collegiate level. He felt that "to hold our own in the race, to do our part in furnishing the world with men educated according to the spirit and demands of the times, we must continue to meet new needs as they arise with as liberal a hand as our means will allow". With a variety of demands pressing in on the institution he felt that the resources of the University should be focused on the "large career" of the University and this entailed the need to discontinue "that part of our present work which is adequately done, both in method and amount, in other schools within the state". Perhaps significantly he ended his argument by saying, "Besides all these points of advantage, the change would promote the dignity and standing of the university".

---

2The Ohio State University Board of Trustees, Twenty-First Annual Report of The Board of Trustees of The Ohio State University to the Governor of The State of Ohio, (Columbus, Ohio: State Printers, 1891), p. 42-44.
While cutting out the lowest level work, the attempt was made to increase the work in the scientific and technical areas and the upper level work. President Scott wrote:

All agree that scientific and technical instruction has a primary claim to recognition in any policy that may be adopted for the university. The physical and natural sciences and their application in the industries of life are assigned a leading place by the law to which the institution owes its origin and the laws by which its endowment has been enlarged. This province has a special claim also in its own right. The tendency of the times, seen in the rapid growth of manufacturing, the opening of new forms of industry, the extension of railroads, the multiplication of engineering structures of every kind and magnitude, the increasing need of scientific knowledge and skill in agriculture, and the spirit and attitude of the general intelligence, call for men familiar with the knowledge and training in the methods that will be of service to society in what are called the practical pursuits. It is a province also which most of the older institutions of learning have not choose or are not able to occupy. The scientific and technical college requires a far greater income than is needed for the work of that class of colleges— it must have a much more extensive equipment in buildings, laboratories, libraries and teachers, and must therefore have a much more liberal support. Here is a broad territory which the policy of the university clearly ought to include.

While the lowest grade of work now done by the university ought to be cut off, there is at the other extreme an open and limitless field. Knowledge is daily increasing, and the pressure of new or extended studies for recognition in the courses of instruction is enormous. By the addition of elective studies some of the courses already present twice as much ground as the student can occupy within the time required for a degree; but the universities of the future will be those that build another story at the top of the present system, and establish libraries, plant laboratories, and employ teachers for a range of study that lies
beyond the boundaries of the present college course. Ohio should have such a university. Here the student of science, both theoretical and practical, of history, literature, philology or philosophy should be carried forward both by institution and by research to the utmost limit of the latest knowledge. Here, also, the light of creative genius should sometimes shine forth and in the progress of time the glory of new knowledge should gather upon the brow of the university. All this should be provided as time advances by extended post-graduate courses in every department of knowledge.3

In order to adjust to this image, the University was divided into six separate and distinct colleges and the entire work of the departments was revised.4 Each college had an independent faculty. A department which served students in several different colleges found it necessary to adjust itself to the ways of these independent colleges. For example, the College of Arts was on the semester system while the Colleges of Engineering and the Pharmacy were on the quarter system. This, together with the different demands of each college necessitated separate courses in elementary chemistry for each group of students. Course 51 and 52, consisting of two semesters, was an elective for the Course in Arts and the Law Preparatory Courses and required in the General Science Course and the Course in Pre-medicine. Course 7, an elementary course of two terms, was required in the Engineering Courses. Course 12, taught in the third term was required in the Pharmacy Course and the Ceramics Course along with Course 7.5

3Board of Trustees, Twenty-Sixth Annual Report, 1895-69, p. 30.
4Ibid., p. 27.
5The Ohio State University, Catalogue for 1896-97, (Columbus, Ohio: The Ohio State University, 1896), p. 29-30.
The presidential reports to the Board of Trustees began to indicate reports of investigations and research. Research in the Chemistry Department was described as being along two lines; "Calorimetric Methods of Water Analysis; and the Constitution of Certain Organic Dyes". The Department was to be in the forefront of the movement to put greater emphasis on scholarly research. In keeping with the spirit of expansion and building the image of a true university, the name of the Department of General Chemistry was changed to the Department of Chemistry. This was perhaps because general chemistry implied elementary or introductory chemistry.

In 1896-97 the total enrollment exceeded 1,000 for the first time. The faculty consisted of 24 professors, 5 associate professors, 10 assistant professors, 3 lecturers, 20 assistants, and 4 fellows and laboratory assistants. McPherson was advanced to the full chair in chemistry. A course in Chemistry was established in the College of Engineering which led to a Bachelor of Science in Chemistry or Metallurgy. This course was in reality a course in Chemical Engineering and eventually was designated as such with the establishment of a Department of Chemical Engineering. The needs of the Chemistry Department were gradually expanded with the expansion in the number of students.

---

6Board of Trustees, Twenty-Sixth Annual Report, 1895-96, p. 47-50.
7University Faculty, "Faculty Records, 1896-97", p. 157.
8Board of Trustees, Twenty-Seventh Annual Report, 1896-97, p. 33.
9Ibid., p. 73.
students the vision of the university character and the growth of the science itself. C. W. Foulks was hired as an assistant and assigned to the work in analytical chemistry. He was promoted to assistant professor in 1898. This addition allowed for the introduction of courses in inorganic preparation, electrolytic analysis, and in sanitary and applied chemistry. McPherson was promoted to full professor in 1897. He had gained the respect of President Canfield, who in his report to the board mentioned that the expert services of Professor McPherson "have been in constant demand".

In 1897 a new course in Commerce and Administration was introduced in the College of Arts. Elementary Chemistry 51-52 was made an elective in the second year of this course.

The end of the 19th century saw a number of changes in the institution. President Canfield resigned and was replaced by William Orley Thompson who sat with the Faculty for the first time on September 13, 1899. The University levy was raised for the purpose of providing for buildings and equipment on March 29, 1900. This

---

1 Board of Trustees, Twenty-Eighth Annual Report, 1897-98, p. 21.


3 Board of Trustees, Twenty-Eighth Annual Report, 1897-98, p. 38.

4 University Faculty, "Faculty Records, 1898-99", meeting of December 14, 1898.

5 University Faculty, "Faculty Records, 1899-1900", meeting of September 13, 1899.

6 Board of Trustees, Thirtieth Annual Report, 1899-1900, p. 22.
provided a basis for the expansion of the physical plant of the University but did not provide for adequate salary expansion. In the Chemistry Department William E. Henderson was hired as an assistant professor to replace, on a temporary basis, Mr. Foulk, who was on a leave of absence for two years to study in Germany. When Foulk returned in 1901 the growth of the department caused the retention of Henderson and the addition of a number of new courses. The expanded offerings and the number of students caused considerable strain on the departmental facilities. President Thompson wrote:

The rapidly increasing numbers of students has caused no greater congestion in any department than in that of chemistry. Relief has been sought by fitting up rooms outside the chemical laboratories for laboratory work of students who could not be furnished laboratory space in the chemical building, but even these were insufficient to provide in a suitable manner for their accommodation. Early in the present year, Professor McPherson and his assistants worked out a scheme for an addition to the present chemical building which would practically double its capacity and it was decided to build a portion of such addition immediately.

The levy increase of 1900 enabled the General Assembly to appropriate $20,000 for the addition. The plans were made by Professor J. N. Bradford and approved by the Governor. The contract was awarded on September 26, 1902 to D. W. McGrath of Columbus for $18,320.00.

---

President Thompson described the building:

The building has been completed, properly equipped with laboratory desks and apparatus and will be ready for use at the beginning of next term.

The addition of chemical hall consists of a two-story and basement wing, added to the north wing of the present structure, 57 feet 10 inches x 70 feet 5 inches and the remodeling of the north wing of the present building which is 40 feet x 63 feet.

The new wing contains about 4,124 square feet of floor to each story.

The materials in construction conform to that of the main structure. The basement walls are of Delaware limestone, rubble masonry laid in cement mortar. The face wall above grade is of dark red pressed brick laid in a red tinted lime mortar backed with local commercial brick laid with neat struck joints on the outside, and painted white. At grade there is a 12 inch course of range work of cut limestone. Brown rock-faced sand-stone is used for belt course and window trim. All inside partitions are of beaded ceiling painted white. The ceilings are finished in the same manner. The floors are double and are of double edged grain pine laid with paper between the two divisions and are supported on wood joists. The joists in turn are carried on build up girders resting on pine posts. All windows are glazed with A.D.S. blown glass. The roof is covered with unfading green slate.

The basement story will be used for industrial chemistry; the first floor will provide a laboratory for work in quantitative chemistry, laboratory for physical chemistry, balance room, instructors offices, instructors laboratories, a preparation room, recitation room, reading room, the necessary corridors and stairways; the second floor contains laboratories for the freshman classes in qualitative chemistry, instructors rooms, balance room and necessary corridors.
In order to keep the air of the room from becoming contaminated with chemical fumes and vapors, the ventilation is made positive by the use of two large fans located in the basement, one a plenum fan for blowing the air of the required temperature into and the other an exhaust fan connected with all the hoods to draw the air out of the room. The temperature of the rooms is automatically controlled by the Johnston systems of temperature regulation, (the air is completely changed in each room every twelve minutes). The artificial illumination is by incandescent electric lamps carried on cleat wiring. All plumbing is of modern exposed type.18

Unfortunately on February 19, 1904 the entire laboratory along with the recent addition burned to the ground.

The General Assembly immediately appropriated $15,000 for temporary space and equipment to allow the work of the Department to continue, but one can well imagine that conditions were not as conducive as possible to good work, especially in light of the fact that the enrollment in chemistry had increased thirty per cent from 1903-04 to 1905-06. An appropriation of $100,000 was made for a new chemistry building to house the work of the chemistry and pharmacy departments and $85,000 for the departments of metallurgy, mineralogy, mine engineering, and ceramics. The new laboratory was occupied in September 1906. This building is the present Derby Hall on campus.

18Ibid., p. 20-21.

The new facilities allowed for a substantial increase in the enrollments in Chemistry. The enrollment in the elementary courses increased steadily, except for the period during World War I, to approximately 1500 by 1925. An even more substantial increase in enrollment was seen in the upper division courses, from about 125 students to 1000 students by 1925. Long before these figures were reached the facilities for the Department were overtaxed.  

Attempt at Consolidation and Correlation

During the first part of Professor McPherson's chairmanship the return of the engineering students required the creation of a second elementary course to accommodate their needs. There was an increasing trend toward such multiplication of courses. This was due in part to the division of the University into six distinct and independent colleges. This independence was such that different colleges were on different systems of school year division. The College of Arts, Philosophy, and Science went on a semester system, while the College of Engineering and Pharmacy remained on the quarter system. This required a revision of the courses in chemistry to coordinate with both systems. On the elementary level, Chemistry 51 and 52 replaced chemistry 1 and 2 for the students in the College of Arts, Philosophy, and Science and in the College of Law. These semester courses were required in the General Science and Pre-medical curricula. They were

20 Board of Trustees, Forty-Ninth Annual Report, 1918-19, p. 29.
21 Board of Trustees, Twenty-Sixth Annual Report, 1895-96, p. 40.
elective for the students in the Latin, Modern Language, and English Courses in Philosophy. Chemistry 7 and 12 were offered on a quarter basis. Chemistry 7 was given in the third quarter. Chemistry 7 was required in the Engineering and Pharmacy Courses. Chemistry 12 was required on the Pharmacy and Ceramic Engineering Courses.\textsuperscript{22}

Various new programs were introduced during this time, but the majority did not require chemistry. In 1899, Chemistry 7-7-12 was added as a requirement in the Course in Industrial Arts and Chemistry 12 was introduced into the third term of all the engineering programs. This resulted in a uniform freshman year for all the engineering students. Simultaneously the credit hours in the engineering-pharmacy sequence was adjusted to a uniform basis of four.\textsuperscript{23} These changes resulted in a large jump in the enrollment in Chemistry 7. It went from 145 students in Autumn of 1898 to 204 students in Autumn of 1899.\textsuperscript{24}

A greater degree of uniformity was achieved in 1900 when all the colleges returned to the quarter system. In the College of Arts, the B.A. degree required three quarters of science or a total of nine hours. The B.S. degree required three quarters of chemistry for a total of nine hours. At the same time Chemistry 51 and 52 were replaced by Chemistry 1.\textsuperscript{25}

\begin{footnotes}
\item[22]\textit{Ibid.}, p. 29-30.
\item[23]University Faculty, "Faculty Records, 1900-01", p. 361.
\item[24]Board of Trustees, \textit{Twenty-Ninth Annual Report, 1898-99}, p. 38; \textit{Thirtieth Annual Report, 1890-1900}, p. 43.
\item[25]Board of Trustees, \textit{Thirty-First Annual Report, 1900-01}, p. 132.
\end{footnotes}
In 1902 the College of Arts went on the Group-Elective System. This was designed to provide a greater flexibility and a freer opportunity for election and opened up the opportunity for students to take a wider variety of courses.²⁶

Under this system fifty-seven term hours were taken from four groups of courses. All of these groups included eighteen term hours to be selected from Mathematics, Physics, Chemistry, Botany, Zoology, Geology and Philosophy. The effect on the enrollment was to increase the number of students in Chemistry 1. A new course at the elementary level, Chemistry 3, of two terms, was introduced to serve the students in the short courses in clayworking, Mining and Pharmacy. In 1902 another elementary course was added to the third term, Chemistry 12a. This course was similar to Chemistry 12, except that it was especially arranged for the students in the short course in clayworking.²⁸

**Correlation with the High Schools**

The discontinuing of the preparatory program at the University in the 1890's had been prompted primarily by the desire to apply greater resources to the collegiate division. Another reason, however, was the better job that the high schools were doing in preparing students for college. For a time the conditions in the high schools had been confused by the addition of new subjects and curricula and

²⁷Ibid., p. 40.
²⁸University Faculty, "Faculty Records, 1902-03", p. 74.
no one model of curricula was greatly accepted. In 1892 the National Education Association appointed the Committee of Ten to examine the condition of the secondary schools. This Committee was dominated by the colleges and reflected to a great extent their needs and views. The Committee report was concerned in general with the problem of preparing students for college entrance, although they did recognize that the high school did not exist solely for that purpose. The Committee recommended that these subjects be included at the high school level: (1) languages - Latin, Greek, English, German and French (and locally Spanish); (2) Mathematics - algebra, geometry, and trigonometry; (3) General History and the intensive study of special epochs; (4) Natural History - including descriptive astronomy, meteorology, botany, zoology, physiology geology, and ethnology, most of which subjects may be grouped under the title of physical geography; and (5) Physics and Chemistry. This report, together with the entrance requirements of colleges, had a profound effect on secondary education. High schools in general adapted their programs so as to point their students toward the type of education proposed by the Committee. Concern for the preparation being given by the high schools was reflected at the University by the formation of the High School Committee. William McPherson was appointed to membership on December 17, 1902.

---

He was to maintain his interest in secondary education over the years. He and Professor Henderson would later write a series of very successful high school textbooks, which were used extensively and helped to develop the high school curriculum in chemistry. In January 1903 a new course designed for students who were expecting to teach high school chemistry was proposed to the Faculty by Professor McPherson. The course, Chemical Pedagogy was offered in the Spring Quarter and taught by Professor McPherson.  

Changes were made to accommodate the diversity among the entering students and the development of some good high school chemistry courses. In March 1903, it was proposed to amend the description of Elementary Chemistry to read—"Arranged for students who have little or no knowledge of Chemistry". The following year a second section of this course, called Elementary Chemistry 1(b), was provided for students who offered chemistry as an entrance requirement. Thus there was an attempt to both influence and adjust to the situation that existed in the high schools. The Chemistry Department was ahead of most of the University in this regard. It wasn't until 1909 that the Entrance Committee recommended to the University Faculty that "those departments offering courses required of freshmen or courses open to election by

30 University Faculty, "Faculty Records, 1902-03", p. 41.
31 Ibid., p. 96.
32 University Faculty, "Faculty Records, 1903-04", p. 48.
freshmen, consider the question of correlation of such courses with the corresponding courses of the high school."  

The Committee pointed out that this had already been done in the departments of modern language and chemistry. Professor McPherson indicated that the modification in some of the elementary courses was due to a "needed change in conditions prevailing in the high schools". In describing the change he wrote that "many of the High Schools now offer a fairly thorough course in chemistry and it is manifestly unwise to assign such students to the same course taken by those who have had no training whatsoever in the science".  

Consolidation of the Introductory Courses  

In 1903 a controversy arose in the Agricultural College which had an effect on the elementary program in chemistry. The controversy arose between Professor Weber of Agricultural Chemistry and the College of Agriculture Faculty. That Faculty held the opinion that "The elementary training in chemistry has not been sufficient to prepare the students for their subsequent technical work in the application of chemistry to agriculture", so they directed that the elementary course in the Department of Agricultural Chemistry be changed to introduce one and one-half terms of elementary experiments on laboratory practice at the beginning of the course. The work in qualitative analysis was to be relegated to the last half of the year, and  

33 University Faculty, "Faculty Records, 1909-10", p. 29.  
34 Board of Trustees, Thirty-Seventh Annual Report, 1906-07, p. 32-33.
quantitative analysis was to be placed in the second year, instead of being taught in the third term. The agricultural students took their elementary chemistry in the Department of Agricultural Chemistry. Professor Weber brought the matter before the University Faculty claiming that the College of Agriculture Faculty had exceeded its authority in putting new work into his course against his wishes. The College Faculty contended that it had the right to specify, "what branches or subdivisions of the subject shall be taken up, in what order they shall be attacked, and what time shall be allotted to each". The University Faculty supported the Professor of Agricultural Chemistry stating that it found that the College Faculty had "exceeded their authority in prescribing what kind of work shall be given as preparatory; in prescribing the division of time between lecture and and laboratory work when both are supposed to constitute preparatory work; and prescribing a textbook, all without the consent of the Head of the Department".35

However, the College of Agriculture solved its problem on February 6, 1905 by transferring the introductory work in chemistry for its students from the Department of Agricultural Chemistry to the Department of Chemistry. All of the agricultural students in the four

35University Faculty, "Faculty Records, 1903-04", p. 12.
year programs enrolled in Chemistry 7-7-12. This resulted in the enrollment in the elementary courses increasing from 405 in Autumn Quarter of 1904-05 to 618 in Autumn Quarter of 1905-06. It was ironic that both Professor Norton and Professor Weber were effected adversely by similar situations.

Professor McPherson welcomed the return of the agricultural students to the Chemistry Department and wrote:

The wisdom of transferring all students in elementary chemistry to one department has been plainly shown. The laboratories for elementary chemistry, while plain and inexpensive in equipment, have been pronounced by many as the most convenient and best equipped in the country. While the number of students is large, the work has been so systematized that each student is constantly under supervision. Assistant Professor Evans has been untiring in his efforts to make this work thorough.37

William L. Evans had been an assistant in the Department and later graduated from the University of Chicago. He was appointed to the Department of Chemistry faculty in 1905 and placed in charge of the elementary work.38 His employment was at least in part a reflection of the increased enrollment in the elementary courses and the need for a more distinct formula for running the program.

36 University Faculty, "Faculty Records, 1904-05", meeting of February 8, 1905.

37 Board of Trustees, Thirty-Seventh Annual Report, 1906-07, p. 33.

38 McPherson, "The History of The Department of Chemistry", p. 646.
The expansion of the University and the formation of many new independent colleges resulted in a competition among the departments for students and resources. This often resulted in a duplication of effort and the necessity for many departments teaching service courses to make provisions for the special needs and demands of several different colleges. It also led to a multiplicity of changes in curricula. The University moved to correct this situation in the early Twentieth Century. In his communication to the University Faculty of October, 1905 the President of the University suggested that the faculty should "be more conservative in its changes in courses". So many changes were being made that it was "impossible for the students to know at the beginning of his course what the requirements for his degree will be". He further stated that it "is not a violation of the truth that an announced course of study leading to a degree is a kind of contract between the University and the student". If modified to any considerable extent "...the interest of the individual student should always be protected" and "...there should be some careful limitation upon the power of Committees to make changes".39

The following year the President Thompson became more specific and recommended a revision in the course of study leading to a greater degree of correlation and less duplication. He stated:

39University Faculty, "Faculty Records, 1905-06", p. 142.
2. This leads me to recommend to the Faculty for consideration the propriety of a more careful revision of the courses of study offered than is now provided. As we all know the matter of the courses of study starts with the department and the first legislation is by the appropriate college faculty. When these courses of study come to the University Faculty in the form of a report it is usual for the Dean of the College to offer a motion to adopt. That motion is very rarely discussed and usually carries. There is a danger that the University Faculty like the English House of Lords will become simply a consenting body, whose dignity is all out of proportion to its utility. The present method in its actual practice provides little assurance that the work in any college shall relate itself readily with that of any other college, or the work in any department with that of any other department. Moreover, intelligent action upon matters is possible only to a portion of the faculty. Now that the College Faculties are to be composed of all having the rank of assistant professor and that many members of the University Faculty will relieve themselves of the burden of attending college faculty meetings, there is a danger that our courses of study may not receive the attention they deserve. This Faculty has strongly urged the autonomy of the department. That is proper and commands unanimous support, so far at least as my information goes. Nevertheless, there is an autonomy of the Faculty as well as of the Department. Whether certain courses now offered should be continued; whether new courses should always be provided because they are offered by a department; whether substantially the same courses in different departments should be continued—those and other questions seem to me to call for a more careful scrutiny of our announcements. In this connection let me add that complaints are sometimes lodged with the president to the effect that the departments are inadequately provided with teachers or equipment or both. On the other hand, there are cases where much time is spent on a very few students in undergraduate work in several groups. These things are presumably approved by the University Faculty and by the college faculties. The question of correlation and duplication cannot even reach the president, but I feel constrained to say that appearances sometimes indicate that the
economy and efficiency could be increased with no loss to education. It would be inappropriate for the president to undertake to specify individual cases without a complete examination that would reveal all the cases where improvements could be made, and conclude on this topic with the suggestion that the University Faculty devise some means by which a more accurate knowledge of courses offered can be obtained and by which more attention can be given to the closer relating of courses to each other.40

In accordance with the wishes of the President, the University Faculty appointed a committee to inquire into and report fully on the question of correlation and duplication of the existing courses of study on February 13, 1907.41 A year later on February 9, 1908, the Committee on Correlation made a partial report to the University Faculty. The report indicated the following:

(1) Twenty-seven of forty-four departments had small elective courses (four or fewer students).

(2) Ten of the twenty-seven departments had had a marked decrease in small courses during 1907.

(3) Eleven of the twenty-seven departments appear too extended for the demand and no decrease is apparent.

(4) Six of the twenty-seven departments appear to have had an increase in the number of small courses.

(5) The frequency of small courses was about twenty-five per cent.

40 University Faculty, "Faculty Records, 1906-07", p. 15-19.

41 Ibid., p. 77.
The Committee further reported that there was not any indication that the small courses were in any considerable number graduate courses. It recommended that a general policy be established to reduce the number of small courses that were electives. They pointed out that this would result in a savings in instructional force in the future, and "ought to commend itself generally in view of the fact that there are known to be departments among us which have not instructors enough to give required work or to handle satisfactorily large elective courses". This policy was not to apply to graduate level courses, courses open to graduate students and specialized seniors only, and courses required for a degree.

On March 11, 1908, the Committee on Correlation presented a supplementary report. This report concerned itself with cases of duplication and supposed duplication of courses of instruction in different departments; cases of lack of correlation among existing courses; and the methods of dealing with these questions which had proved successful in other institutions, and which in the opinion of the Committee should be tried at the Ohio State University. The Committee reported as follows:

---

42 University Faculty, "Faculty Records, 1907-08," p. 145-146.
43 Ibid., p. 158.
The first case of duplication which the committee presents is that in the chemical work of the University. It is well known that at present there are (exclusive of the Department of Chemistry) four different departments in which considerable chemical work is carried on, viz., Agricultural Chemistry, Ceramics, Metallurgy and Pharmacy. The chemical work of the first year of all these courses is done in the Department of Chemistry and consists of elementary chemistry and qualitative analysis. In the second year the departments of Agricultural Chemistry, Ceramics, and Metallurgy withdraw the students, each department maintaining a year's work in quantitative analysis. The Chemical Engineering students, together with the students of the College of Pharmacy and of Arts, take a year's course in quantitative analysis in the Chemical Department. There are thus four courses in quantitative analysis, and since they are all beginning courses, it is obvious that a considerable fraction of each of them must be substantially the same work. All of the chemical work subsequent to the second year is concluded by the several departments save the organic chemistry of the Pharmacy Course and a few electives. For the next term the Ceramic students will take a term's work in physical chemistry in the Chemical Department. In this distribution there has never been any recognized plan, nor has the matter of correlation ever been definitely discussed.

In view of this situation, and after careful study of many other universities, the committee submits the following conclusions and recommendation: Since elementary chemistry, qualitative and quantitative analysis, all foundation chemical studies upon which any specialized technical training must rest, and since in other institutions it is almost universal policy to retain these studies in one department in the interests of organization and economy, we recommend as a policy the centralization of this work in the Department of Chemistry. As a plan for accomplishing this centralization we recommend the following: Wherever the departments of Agricultural Chemistry, Ceramics, or Metallurgy are, through their development, required to ask for more instructional force or for more room,
this request be met by retiring their un-
specialized work into the Department of
Chemistry and providing the latter with
the necessary space and instruction.\textsuperscript{44}

The Committee also recommended a reorganization of the University so
as to avoid duplication and to increase correlation between the
different departments. It proposed a system of divisions made up
of departments with similar interests. Their report stated:

In the opinion of your committee the
most effective method of avoiding duplication,
making adjustments between courses of instruction
and filling in obvious gaps in the University
curriculum, that is, of handling the whole
question of correlation, is by the simple plan
of having certain natural groups of departments,
to be called Divisions, as is done in other
universities. The department of a Division can
then meet in council to determine the relations
of existing courses and to consider and approve
new courses before such courses are submitted
to the Committee on Instruction of the Univ-
ersity Faculty for its approval.\textsuperscript{45}

The Committee recommended that thirteen divisions be established. The
Department of Chemistry, along with Agricultural Chemistry, the courses
in chemistry in the Department of Clayworking and Ceramics, the course
or courses in Metallurgical Chemistry and the courses in Chemistry
of the College of Pharmacy all constituted Division V, that of
Chemistry.

The Division was to be composed of all the appropriate regular
teaching staff from instructor to professor. It was to be empowered

\textsuperscript{44}Ibid., p. 158-166.

\textsuperscript{45}Ibid., p. 165.
to pass on new courses and changes in courses of instruction for the
division, after which they were to go to the Committee on Instruction.
The purpose of the Committee on Instruction was to make sure that there
was correlation of courses both among the related departments and
among the colleges. It recommended that the Committee on Instruction
be established as a standing committee, with seven members to be
appointed by the President. All reports of new courses and changes
in courses from the divisions would be submitted to the Committee on
Instruction.46

There were objections to the Committee on Correlation's report
and Professor Orton submitted a minority report in which he disagreed
that the work in quantitative analysis was essentially similar in the
various departments. He held that there was really a considerable
amount of professional work in these courses. He stated: "In short
the courses are primarily technical courses, and the Quantitative
Chemistry is merely the vehicle by which this information is given to
the students".47 However the basic ideas of the Committee were adopted
on May 13, 1908.48

The Department of Chemistry was established as the home of all
basic courses in chemistry and this had the effect of substantially
increasing the number of students, the number of staff members, and

46 Ibid., p. 166.
48 Ibid., p. 178.
the resources of the department. It helped to provide an effective basis for the expansion of the department in the area of graduate education and scholarship. The enrollment of the students above the elementary level increased markedly from 1908-09, when it was about 345, to 1909-10, when it was 531.49

The new policies and organizational set-up enabled the elementary courses to become more stabilized because there was less pressure to differentiate instruction simply to meet the requirements of different colleges and curricula and allowed the possibility for differentiation to be based on differences in the student's preparation and ability. The procedures were not wholly effective in cutting down on the number of small sections. In 1909, the President spoke to the faculty on the dangers of lateral expansion. He objected to the multiplication of courses and saw in this evidence for inter-departmental rivalry. He pointed out that many courses were being offered by departments for the accommodation or convenience of other departments.50 In 1911 he still referred to various criticisms being leveled at the University and pointed out that there were sixteen classes with one student; seventeen classes with two students; and thirty one classes with three students, not including

49 Board of Trustees, Thirty-Ninth Annual Report, 1908-09, p. 245; Fortieth Annual Report, 1910-11, p. 286.
50 University Faculty, "Faculty Records, 1909-10", p. 31.
small classes designated as "graduate", "Seminar", or "thesis work".  

In 1916, Professor Foulk "moved that the Divisions existing between related departments for consideration of new courses and changes in courses, be abolished and that all rules or parts of rules affected by this action be repealed". The motion was adopted by the University Faculty. The Committee on Instruction remained and continued as the body charged with the correlation of the course structure. Although not wholly successful, this movement toward correlations did strengthen the position of the chemistry department and did something to stop the tendency for fragmentation in the elementary courses because of the specialized demands of other units. A uniform requirement of four hours in chemistry had been adopted by both the Arts College and the Engineering College. The Arts College had required a three hour course and the Engineering College a five hour course. However, it was still necessary for the Chemistry Department to have special courses for the short course students, their work being entirely separated from the students in the four year courses.

In 1910-11 the semester system was adopted by all the colleges and the elementary courses went on a new numbering system. Chemistry 101-102 was designed for the students in the short courses and veterinary medicine. Chemistry 105-106 was designed for students without

---

51 University Faculty, "Faculty Records, 1911-12", p. 25.
52 University Faculty, "Faculty Records, 1916-17", p. 50.
53 Board of Trustees, Thirty-Seventh Annual Report, 1906-07, p. 32.
an adequate background in high school chemistry. Chemistry 109-110 was designed for students with high school chemistry. Thus, except for the 101-102 course, the elementary courses in chemistry were now organized on the basis of student preparation rather than the requirements of the different colleges. The students from the College of Arts, Agriculture, and Engineering all took whichever course they were prepared for by their high school experience. The 101-102 sequence was gradually phased out, because of decreasing enrollment in the short courses and after World War I it was discontinued.

Correlation With Other Colleges

The tendency toward correlation and efficiency also led to the formation of various combined programs. In 1906 a combined Arts-Law-Program was initiated and this was followed by other combined programs such as Arts-Engineering and Arts-Commerce. In 1909 the various colleges within the University began to uniformize their entrance requirements. In 1912 the President called for the activities of the Entrance Board, the Schedule Committee, and the Appointments Committee to be handled by an administrative officer with clerical help.

This tendency toward greater correlation extended beyond the institution to co-operation with other institutions. In 1910 the Engineering College endorsed the idea of formal transfer arrangements

---

54 University Faculty, "Faculty Records, 1909-10", p. 88, 96, 106, 110, 136 and 142.

55 Board of Trustees, Thirty-Sixth Annual Report, 1905-06, p. 15.

56 University Faculty, "Faculty Records, 1912-13", Meeting of October 2, 1912.
from other colleges into the Engineering College and granted liberal concessions as to substitution of credits. The Dean of the Engineering College wrote:

The arrangement of a formal scheme of cooperation with our own College of Arts, Philosophy and Science has been regarded as a necessary precedent to another and more important project, viz., cooperation with the College of Liberal Arts of the entire State and elsewhere. The State University will never assume its proper and rightful sphere of influence in the State until it is in active co-operation with every educational institution in the State, high or low. The provision by the State of equipment for the training of men in all of the branches of technical and professional education-equipment far larger and more comprehensive than private institutions can possibly be expected to provide—makes it not only logical and proper but also incumbent upon us to encourage other institutions to make use of these facilities. The early work in Mathematics, Physics and Chemistry can very often be done as well or better in other schools than in our own crowded classes and laboratories, and the cultural work certainly can. By offering clear-cut modes of cooperation to other schools by which they may with self-respect still place their degree upon their product and still help them to get under more favorable circumstances the technical and professional work which they must ultimately have, this institution will be making a long stride toward that leadership which it ought to hold. The College of Engineering is anxious to have these co-operating agreements with other Ohio Colleges ratified as fast as is consistent with security. It hopes by this means to fill its upper classes with desirable material without increasing the already large proportion of freshman.

57 University Faculty, "Faculty Records, 1909-10", p. 176.
58 Board of Trustees, Forty-First Annual Report, 1910-11, p. 104.
In 1910 Professor McPherson was appointed to the Committee on Cooperation with Colleges. In 1911 President Thompson referred to the Committee and expressed concern with the relationship of the University with other colleges both in the state and the nation.

On February 8, 1911 the University Faculty approved of the attempt of the Ohio College Association to standardize the freshman and sophomore years and indicated its willingness to cooperate with these efforts. In May of 1911 the College of Agriculture approved a combined Arts-Agriculture program and in June many of the colleges of the University agreed to confer with other Ohio Colleges with a view toward the arrangement of combination courses. In 1914 a conference was held with representatives from the Ohio State University, Miami University and four state normal schools with the chief purpose being to discuss the general educational system of Ohio as it was related to these institutions with a view to securing uniformity in courses of study and to prevent undue duplication of work.

59 University Faculty, "Faculty Records, 1909-10", p. 171.
60 University Faculty, "Faculty Records, 1910-11", Meeting of January 11, 1911.
61 University Faculty, "Faculty Records, 1910-11", p. 117.
62 Ibid., p. 138 and 156.
63 University Faculty, "Faculty Records, 1913-14", p. 229.
Movement Toward University Status

Related to the movement toward cooperation and correlation with other institutions was desired by the institution to attain a true university posture. This involved an increasing emphasis on the higher level work and the trappings of scholarship and research. It can be seen in the comments of the Engineering Dean, that there was an attempt to establish the institution as the center for the upper division and professional education in the State. This vision was to profoundly alter the character of the institution.

It has been mentioned that as early as 1891, the president proposed the abandonment of the preparatory program so that the resources could be altered to the collegiate institution and "to promote the dignity of the institution". In 1896 the preparatory program was abandoned and the University was divided into six distinct colleges. But the actual opportunity for the faculty to engage in scholarly activities was limited very severly. In 1898 the President commented on the investigation and research at the institution by saying:

It is to be confessed with regret that the members of our Faculty have very little time for original work. Until we can have two Faculties--one for instruction and one for investigation and research--we must give our time and strength almost entirely to instruction.

---

64 Board of Trustees, Twenty-First Annual Report, 1891-92, p. 42.
65 Board of Trustees, Twenty-Sixth Annual Report, 1895-96, p. 27.
66 Board of Trustees, Twenty-Eighth Annual Report, 1897-98, p. 38.
He goes on to say that some have made time for investigation and mentions that the expert services of Professor McPherson and others "have been in constant demand."

One of the severe restrictions on the advancement of scholarship and research was financial. However, in 1900, the legislature authorized an increase in the University levy for the sole purpose of erection and equipment of buildings. While this made funding available for physical equipment, the University operated under a severe handicap insofar as salaries were concerned. The original salary for a professor when the institution was founded was limited by the legislature to $2500. The Board of Trustees had reduced that maximum to $2250 shortly after the University opened. Not until 1905 did the Board reinstate the salary of $2500 for heads of departments. At that time the President objected to the legal limit of $2500 and pointed out that public school teachers were paid in excess of $2500. The legislature was asked to repeal the $2500 limit but in 1908 the President reports that he had to promote fifteen men to professor without being able to make suitable salary adjustments. In 1912 the President writes that "one of the most pressing problems now existing is the provision of sufficient money for salaries." In 1913 the

---

67 Board of Trustees, Thirtieth Annual Report, 1899-1900, p. 22.
68 Board of Trustees, Thirty-Fifth Annual Report, 1904-05, p. 22.
69 Board of Trustees, Thirty-Eighth Annual Report, 1907-08, p. 6.
70 Board of Trustees, Forty-Third Annual Report, 1912-13, p. 6.
President complained that the low salaries made it necessary to promote men to professors in place of appropriate salary increases.71

G. W. Knight, the chairman of the Administrative Board in describing graduate study and scholarship at Ohio State wrote that prior to 1900 there was little in the way of systematic provision for graduate study and that it often consisted of the individual student returning for an additional year's study usually involving electives which they were unable to take during their undergraduate years. The work differed little from a fifth year of undergraduate work. However, in the years immediately prior to 1900 there was a rapid increase in the facilities and equipment of the university and a demand within the state for the opportunity to do advanced study and research. In 1902 a Graduate School was organized within the College of Arts, Philosophy and Science to coordinate and supervise graduate work. In 1905 the General Assembly of Ohio authorized and required the University to maintain and develop its graduate instruction.72 Knight pointed out the need for increased facilities for graduate work, the need, at least in some departments, for one or more of the instructional force to devote all or most of this time to graduate instruction, the need for graduate instruction to be accorded the same kind of recognition in provisions for instruction

71Board of Trustees, Forty-Fourth Annual Report, 1913-14, p. 9.
72Board of Trustees, Thirty-Sixth Annual Report, 1905-06, p. 65-68.
as undergraduate work, and the need for a sharper differentiation between graduate courses and advanced undergraduate courses. In 1906 the President pointed to the desirability of the graduate work of the university being organized in a more comprehensive fashion.\textsuperscript{73}

That the university still had a way to go in achieving recognition as a true university was evident from a letter from the Carnegie Foundation for the Advancement of Teaching replying to the requests of three Ohio institutions to be admitted to certain privileges of that organization:

\textit{It is quite evident that the three state universities are not all real universities. That designation may fairly be conceded to Ohio State University, and, if relieved from the pressure of state competition, it would no doubt assume within a reasonable time, the efficient and orderly development of such an institution as the University of Wisconsin.}\textsuperscript{74}

In the area of providing time for the faculty to engage in productive scholarship the university continued to face the problem of increasing enrollment and heavy teaching loads. Teachers were carrying from fifteen to eighteen hours. It was often necessary to make emergency appointments to take care of heavy enrollments in the elementary courses. The President saw a danger in this and stated that all such appointments should be temporary, without promise of future

\textsuperscript{73} University Faculty, "Faculty Records, 1906-07", p. 15.

\textsuperscript{74} Board of Trustees, Thirty-Ninth Annual Report, 1908-09, p. 11-12.
promotion. He also suggests that promotion should be "conditional upon what may be termed legitimate tests of a man's right to academic recognition and promotion".\textsuperscript{75}

In 1908 the Faculty of the College of Arts, Philosophy and Science adopted a motion that the instructional load of a faculty member be lightened if in the judgment of the Graduate Board any work of investigation carried on in the College is of sufficient importance to warrant action.\textsuperscript{76}

In 1904 President W. O. Thompson indicated that a leave of absence with salary had been granted to Professor Derby and hoped that this would set a precedent.\textsuperscript{77} In 1910 he wrote that five were on leaves of absence, including Professor Henderson of Chemistry. He stated that the custom had beneficial effects and that:

\begin{quote}
The University can reasonably expect from its teaching force stimulating effect of increased interest in scholarship and especially in the problems of education. For many years there has been a revival of interest in the universities concerning the question of scholarship. It is gratifying to see now that the problems of applied scholarship are being recognized and that one of the important functions of the state university is to make such use of scholarship as will produce a
\end{quote}

\textsuperscript{75}University Faculty, "Faculty Records, 1908-09", p. 23.

\textsuperscript{76}Ibid., p. 50.

\textsuperscript{77}Board of Trustees, Thirty-Fourth Annual Report, 1903-04, p. 30.
company of alumni who are the best justification for the maintenance of the university.\textsuperscript{78}

In 1911 he wrote that he was continuing his policy of leaves of absence but was maintaining a conservative policy until the public was more aware of the benefit.\textsuperscript{79}

That same year the University Faculty adopted a report favoring the organization of a separate Graduate School.\textsuperscript{80} William McPherson was elected the Dean of the Graduate School and at the same time continued as Chairman of the Chemistry Department.

The formation of the Graduate school gave added impetus toward the emphasis on attaining "university status". The enrollment of the graduate school began to increase substantially. In 1912-13 its enrollment was thirty per cent greater than that of the prior year, although it still only totaled 127 students.\textsuperscript{81}

President Thompson viewed the graduate school as a stimulus to the faculty, a stimulus which would inspire their teaching, along with the development of an attitude and acceptance of scholarship. He wrote:

\begin{quote}
The Graduate School in its brief experience has already proved a stimulus to the Faculty. It provides the incentive to scholarship that\end{quote}

\textsuperscript{78}Board of Trustees, \textit{Fortieth Annual Report, 1909-10}, p. 5.
\textsuperscript{80}University Faculty, "Faculty Records, 1910-11", p. 134.
\textsuperscript{81}Board of Trustees, \textit{Forty-Fourth Annual Report, 1913-14}, p. 21.
opportunity for development does to a man in business. In a sense it may be agreed that a graduate school is for the salvation and development of a faculty since it provides against the tendency to monotony and deathly routine in teaching. The inspiring teacher needs the wider horizon that comes with his own participation in the activities of research and scholarship. Moreover the presence of the graduate school has developed the graduate attitude of mind in a portion of the student body and opened the way to the development of a body of young scholars who represent some of the best phases of university life. The contribution to university efficiency and to the general attitude toward scholarship would be in itself a sufficient justification for the generous maintenance of a graduate school.82

In 1914 the legislature authorized $10,000 for a system of graduate fellowships and scholarships,83 and in 1916 research professorships were established.84

This emphasis on scholarship brought with it a concern for the scholarly ability of the faculty. In 1915-16 the President reported that there was a growing sentiment among the faculty that promotion in rank should involve a demonstrated ability to direct and conduct graduate work.85 A Committee appointed to consider the general question of what could be done to promote further productive scholarship at the university, in cooperation with a committee appointed by Sigma Xi, made the following recommendations which were adopted by the Graduate Council:

82Board of Trustees, Forty-Fourth Annual Report, 1913-14, p. 21.
84Board of Trustees, Forty-Sixth Annual Report, 1915-16, p. 7.
85University Faculty, "Faculty Records, 1915-16", p. 6.
(1) That it be general policy of the university not to appoint to the rank of assistant professor or to a higher rank any person who had not already given clear evidence of power to do productive work.

(2) That in all promotions and increases of salary equal weight shall be attached to scholarly productiveness and teaching ability and that where evidence has been given of extraordinary scholarly productiveness this quality shall carry most weight. It should be the aim of every university to have a group of notable creative scholars.

(3) That normally no person shall be advanced to the rank of full professor who has not given evidence of continued activity in scholarly research since his original appointment. This condition is not intended to preclude increase of salary when members of the instructing staff who are not productive scholars have shown extraordinary ability as teachers.

(4) That as soon as possible the expected number of hours teaching be reduced for those giving graduate instruction, and, indeed for all persons qualified for, and engaged in productive research. The normal maximum number of calendar hours should be from eight to ten according to the subjects and methods of instruction, for those giving graduate instruction. This university should at once in the work of its
instructing staff come down to the time standards in force in the teaching state universities. In this regard our faculty should not be handicapped in comparison with the faculties of the universities of Wisconsin, Illinois, and Michigan. We believe that those professors who give graduate work should have a maximum above which no productive scholar should under any circumstances go, but that there should be no minimum. If a man is of sufficiently high character and attainments to be made a professor it should be left to his own discretion to determine how many hours it is expedient for him to teach.

(6) That those members of the permanent instructing staff who are engaged in serious and prolonged efforts in the line of productive scholarship shall upon request, to be preferred through the Dean of the Graduate School, be relieved from a part of their routine duties.

(7) That a regular scale minima and maxima in salaries for the various grades of teachers be adopted, together with a regular scale of increases to the maxima for length of service. This policy should not be regarded as fixing an upper limit for the salaries of distinguished scholars with the rank of full professors.86

---

86 Board of Trustees, *Forty-Fourth Annual Reports, 1913-14*, p. 25-26
McPherson reflected the views of many leading educators of the day when he quoted a university president as stating: "A true University can exist only where a group of investigators in the chief departments of Arts and Sciences are at work on the frontiers and knowledge". In referring to the extensive discussion as to whether research work carried on by an instructor added to or detracted from his teaching efficiency, McPherson wrote that "research work gives life and enthusiasm to college and university teaching and that the institution which fails to provide for it, is doomed to have mediocre teaching".

Thus, at Ohio State, the emphasis on scholarship and research, and the attempt to decrease the teaching load, was justified primarily on the basis that it was necessary "to enliven the spirit on instruction." McPherson stated that "To organize and to stimulate research, therefore, is the University's chief business." It would be many years before the stimulation of research actually became the chief business of the University, but the move to achieve this end was to be very instrumental in the manner in which the introductory program was administered and it led to a number of problems in the area of freshman education.

During this time the Chemistry Department underwent a great expansion. In 1900-01 there were 266 students enrolled in the

---

87 Board of Trustees, **Forty-Third Annual Report, 1912-13**, p. 56.
88 Board of Trustees, **Forty-Fifth Annual Report, 1914-15**, p. 40.
89 Board of Trustees, **Forty-Sixth Annual Report, 1915-16**, p. 39-40.
elementary courses and 87 in upper level courses; by 1915-16 there were 1041 students enrolled in the three elementary courses and 712 in upper level courses. The number of courses beyond the elementary level had increased from ten to over thirty. The number of graduate students increased from a handful to over sixty. The faculty of the department expanded to keep pace with the enrollment and the expansion of the discipline itself. As we have seen in 1897 Charles W. Foulk was hired as an assistant professor and assigned to the work in analytical chemistry. In 1899 Foulk was given a leave of absence to study under Ostwold at Leipzig and William E. Henderson was hired to carry on his work. This enabled the department to expand its offerings in physical chemistry. Mr. Henderson was retained as a permanent staff member on Foulk's return. The expansion in the number of students required an addition to the Chemistry building which was completed in 1903, but was completely destroyed by fire the following year. The cause of the fire was attributed to an assistant who had "carelessly left a gas burner lighted". The General Assembly immediately appropriated $15,000 for temporary space to allow the work to continue, although it was interfered with. The General

90 Board of Trustees, Twenty-Eighth Annual Report, 1897-98, p. 21.
91 McPherson, "The History of The Department of Chemistry", p. 645.
92 Board of Trustees, Thirty-First Annual Report, 1900-01, p. 22.
93 Ibid.
Assembly appropriated $100,000 for a new chemistry building which was to house only the Department of Chemistry and Pharmacy. The new laboratory building was occupied in 1906-07. By 1905 the number of students in elementary chemistry had grown to 600. William L. Evans was hired as assistant professor and placed in charge of the elementary courses. James R. Withrow was added to the staff in 1906 and placed in charge of the work in industrial chemistry. In 1924 the work in industrial chemistry would be placed under his chairmanship in the Department of Chemical Engineering.

By 1915-16 the faculty of the Department consisted of:

**Professors:** Sidney S. Norton (Emeritus)

William E. Henderson

Charles W. Foulk

William L. Evans

James R. Withrow

**Assistant Professors:** Shipley

Cecil E. Board

along with an instructor, seven assistants and eighteen graduate assistants. During this time the nature of the Department changed

---


95 McPherson, "*The History of The Department of Chemistry*", p. 645.


98 See the Faculty and Staff Directory for 1915-16, published by The Ohio State University.
radically. Around 1900 McPherson and Henderson had taught virtually across the board. For example, in the first term of 1901-02 McPherson was involved in ten courses. He had at least twenty contact hours per week. The expansion of the staff, especially the junior staff, enabled the professors to concentrate and specialize in certain areas. McPherson and Henderson continued to teach in the elementary courses but the job here was made easier by the introduction of graduate assistants to teach laboratories and occasionally recitations.

In 1900 the numbers of fellows and assistants in the Department was three. By 1915 the number had increased to twenty-five. In this same time period the number of elementary students increased from 286 to 1041. So the number of students had increased less than fourfold but the number of junior staff members had increased eightfold. This enabled the senior staff men to lower their teaching loads, although their loads were still heavy.

The addition of William L. Evans in 1905 to the staff and his assignment to take charge of the elementary sections allowed McPherson and Henderson to concentrate on the upper level courses. The 1907 catalog indicates that Evans had charge of the elementary sections in courses 3 and 7. McPherson taught General Chemistry 44, along with

99 Board of Trustees, Twenty-Sixth Annual Report, 1895-96, p. 117.
100 Board of Trustees, Forty-Sixth Annual Report, 1915-16, p. 88.
101 See the catalogs of The Ohio State University for this period.
various organic courses and the Teaching of Chemistry. Henderson also taught General Chemistry 44 and courses in physical, inorganic, and historical chemistry.

Throughout the University the movement toward greater scholarship and research was promoted by the fact that increases in salary and promotion were to be based at least partially on at least outward evidence of accomplishment in this area. This had the effect of encouraging instructors to move from the elementary courses to more advanced courses where there were fewer students and these students were at a higher level of accomplishment.

J. V. Denney, Dean of the College of Arts, wrote:

A perplexing problem in every university is how to prevent the multiplication of undergraduate courses that enroll very few students; and how to provide a sufficient number of good instructors for the courses (mainly elementary) that enroll large numbers. There is no doubt that instructors needed for the overgrown classes composed of underclassmen are (for part of their time at least) shifted to higher work after their first year of service. The result is a constant demand for more instructors and inordinate increase of small classes in the upper undergraduate years.102

Another problem with the teaching of the large elementary sections was the continuity of the elementary courses when taught in more than one lecture section. Some of the elementary courses had to be subdivided because of scheduling problems. In 1915, the

102 Board of Trustees, Forty-Seventh Annual Report, 1916-17, p. 11.
Schedule Committee's recommendation that it be allowed to schedule more than one lecture section for schedule flexibility was adopted by the Faculty. At the same time, however, they refused to adopt a recommendation that each department be organized so that one man was placed in charge of each course.\footnote{University Faculty, "Faculty Records, 1915-16", p. 157.}

Thus the situation was one in which:

1. the emphasis was switching to the provision of advanced courses and research;
2. promotion was to be based, at least significantly, on evidence of scholarship;
3. the President had recommended that appointments at the elementary level should be temporary.\footnote{University Faculty, "Faculty Records, 1903-04", p. 23.}
4. the number of elementary students was increasing at the same time as the number of advanced students was increasing;
5. multiple lecture sections of some courses were required because of scheduling difficulties.

The chemistry department, as has been mentioned, undertook to adjust to both the demands for more commitment to scholarship and the expansion of upper division and graduate offerings, and the needs of the elementary courses by assigning W. L. Evans and to task of administering these courses.\footnote{Board of Trustees, Thirty-Seventh Annual Report, 1906-07, p. 34.} Evans sought to bring some degree
of order and supervision into the elementary courses and to organize them in an efficient manner. McPherson writes in his report of the Department in 1906 that "while the number of students is large the work as been so systematized that each student is constantly under supervision. Assistant Professor Evans has been untiring in his efforts to make this work thorough". McPherson further indicates that even with the large increase in enrollment due to the agricultural students taking their elementary chemistry in the Chemistry Department, they were able to introduce a number of lecture courses for advanced and graduate students. He states that the "number of such students has been steadily increasing and every effort is being made by the Department to encourage them and to make this branch of work of a high order".106

The movement toward graduate work along with the needs for instructors at the elementary level led to the expansion of the system of assistantship. The establishment of this form of financial aid was viewed as a necessity in the competition for qualified graduate students.

McPherson defends the system against those who object to the subsidization of graduate work on the ground that a university should be able to attract students by the reputation of its scholars by pointing out that the policy is universal among all graduate schools.107

---

106 Ibid., p. 33.

107 Board of Trustees, Forty-Third Annual Report, 1912-13, p. 56.
The needs of the University and the Department thus pointed to the employment of more assistants to perform duties in the large elementary courses. Initially the policy was that the assistants should not be placed in charge of classes or be permitted to give class instruction. Gradually, however, as the demand increased, assistants were assigned to a classroom situation. McPherson stated that during the 1916-17 academic year, 53 graduate assistants were employed by the university. Only seventeen held a limited number of recitations varying from two to eight a week. This tendency was greatest in the departments of English, German, Romance Languages, Economics, and Sociology. In the Department of Chemistry only four recitations were given each week by an assistant. He points out that this circumstance had been forced on the departments because of insufficient instructional staff but that he was convinced that in most cases the work was well done but that "the assignment of regular classes to graduate assistants, however, is a procedure that cannot be justified except in very unusual cases". He pointed out that there are many minor duties in certain departments where a large number of freshmen are enrolled that can be performed efficiently with graduate assistants. "By utilizing such assistants, the University not only opens unusual opportunities to a select group of young men and young women, but at the same time relieves a number of professors of many

108 Board of Trustees, Thirty-Sixth Annual Reports, 1905-06, p. 68.
tasks that can be performed just as efficiently by those of less training and experience. There are still too many professors who spend much of their time doing work which can be just as effectively done by those of lower rank. No University can afford to employ competent professors and then load them down with work that requires no special training". 109

While the employment of graduate assistants enabled professors in the department to spend more time on scholarly activities this was a reciprocal process. The need for a large number of assistants in the big elementary sections of some departments aided the growth of their graduate programs. McPherson states that "it is only fair to say that the relatively large enrollment in the departments of Chemistry and English is partially due to the fact that these departments have a number of graduate assistants in their instructional forces". 110 Perhaps another factor in the rapid development of the graduate program in chemistry was the influence of the textbooks written by McPherson and Henderson. Caley reported that the long series of successful college and high school textbooks by Professor McPherson and Henderson, which started in 1905 and became widely used, especially after 1915, were very instrumental in making a national reputation for


110 Board of Trustees, Forty-Fourth Annual Report, 1913-14, p. 23.
the Department. This undoubtedly attracted a number of students to the graduate program of the Department.

Thus as World War I approached the University was reaching toward true university status. It had attempted to correlate the first two years of the undergraduate curriculum with other colleges within and without the University. The organization of the Graduate School and the provision of assistantships prompted the University to cope with the expanding enrollment by using assistants in the elementary courses for some of the ordinary duties, thus encouraging the professors to concentrate on scholarly activities. The Chemistry Department had been early in attempting to correlate its elementary program with that of the high schools and McPherson and Henderson exerted a significant influence on both high school and college teaching by their various textbooks on introductory chemistry. The correlation of the work within the University resulted in the Chemistry Department gaining control over all elementary and introductory chemical courses. The need to apply efficient and effective methods to the teaching and administration of these large numbers of elementary students led to the appointment of an individual to coordinate the efforts in this area and to the provision of a substantial number of graduate assistants which in turn gave a strong impetus to the graduate program in Chemistry.

---

111 Caley, Earle R., History of The Department of Chemistry of The Ohio State University, (Columbus, Ohio: The Ohio State University, 1970), p. 5.
CHAPTER IV

THE EVANS ERA

The Effect of World War One

World War I had both a short term immediate effect and a long term effect on the University and the Department of Chemistry. President Thompson described the war as accounting for "many temporary and local changes and adjustments."\(^1\) J. V. Denney wrote that the most notable loss of students was in the upper class and graduate courses and that this released the teaching staff from their duties in the upper level courses to each in the elementary courses.\(^2\)

The decrease in enrollment from 1916 to 1917 was as follows:

<table>
<thead>
<tr>
<th>TABLE 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIVERSITY ENROLLMENT - 1916 - 1918(^a)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1916</td>
</tr>
<tr>
<td>Graduate School</td>
</tr>
<tr>
<td>Freshman Class</td>
</tr>
<tr>
<td>Other Classes</td>
</tr>
<tr>
<td>Total Enrollment</td>
</tr>
</tbody>
</table>

\(^a\) Taken from: University Faculty, "Faculty Records, 1917-18", p. 76; "Faculty Records, 1918-19", p. 69; figures are for fall quarter.

\(^1\) Board of Trustees, Forty-Eighth Annual Report, 1917-18, p. 10.

\(^2\) Ibid., p. 14.
The increase in enrollment in the 1918 figures reflects the Student Army Training Corp. program.

Denny described the difficulties of the year in the College of Arts as follows:

As in all other colleges, the work of the year was prosecuted under severe difficulties. Chief of these was the unsettled condition of mind among students and faculty. Withdrawals of students were so numerous as to be noticeable in many classes. Changes of teachers was so frequent as to impair the quality of the work in several departments. Added to this was the physical discomfort in some buildings owing to inadequate heating, and the uncertainty as to the continuance of college. All of these conditions were borne with good spirit, for the most part, as unavoidable in time of war and public excitement.

In the Chemistry Department William McPherson and W.L. Evans were on leaves of absence for war service. Professors Henderson, Boord, and Withrow also spent much of their time on war duties. Marion Hollingsworth and Jesse E. Day were added to the instructional staff with the rank of instructor to help take up the slack. These additions were further augmented by the employment of more assistants and the use of student assistants.

The loss in regular enrollment was quickly replaced by other activities. There were a number of military organizations on campus.

\[3\] Ibid.
\[4\] McPherson, "The History of the Department of Chemistry", pp. 646-47.
\[5\] Board of Trustees, Forty-Ninth Annual Report, 1918-1919, p. 9.
These included a school for Military Aeronautics, commonly called the Aviation Ground School, a school for Adjutants, a school for Balloonists, and later the Student's Army Training Corps (S.A.T.C.). The latter was a combination program of general education and military training. It provided preliminary training as officers. This created a sudden demand for extra instructors in English, French, Spanish, Mathematics, and Chemistry. This was met primarily by transferring instructors from the other departments. 6

The war also lead an appreciable effect on the research and public service area of university endeavor. The National Academy of Science established the National Research Council to maintain an inventory of equipment, men, and the lines of investigation being conducted. It also was to act as a clearing house and a coordinating agency in an attempt to secure efficiency. It also supported educational institutions in efforts to secure funds and to create conditions favorable to research. 7 At Ohio State President Thompson was authorized to appoint a research committee. 8 The Engineering Faculty resolved to

6Ibid., p. 18.
7University Faculty, "Faculty Records, 1916-1917", p. 105.
8Ibid., p. 104-105.
offer its services in industrial research to the federal government. Many professors on campus engaged in cooperation with the government in technical and administrative problems. An experiment station was established and maintained by the federal government in the area of Ceramic Engineering.

In this way the value of the University and especially the technical know-how that it provided became more apparent to the government and the general public. The limited exposure that many young people had at the University was to encourage them to return on their own.10

After the war there were increased demands on the University. There was first of all a large increase in enrollment. In the fall of 1919-20 the enrollment was 6608.11 In winter of 1918-19 the enrollment had only been 3588.12 In five years the enrollment would be 10,000. President Thompson attributed this increase in attendance to the point of view of modern democracy of providing education for the many. This coupled with a policy of upgrading and expanding the high schools, laws protecting children and youth up to the age of 16, which opened the way for a larger participation in elementary education, and the increased financial ability of people to educate their children created a demand for a college education. Thompson saw that demand as growing and that

9Ibid., p. 102.
10Board of Trustees, Forty-Ninth Annual Report, 1918-1919, p. 11.
11University Faculty, "Faculty Records, 1919-1920", p. 43.
12University Faculty, "Faculty Records, 1918-1919", p. 69.
"no devices invented by faculties or other organizations of educators will prevent an increasing tide of young men and young women who desire higher education."\(^{13}\)

There was also a movement for the extension of the resources of the University throughout the State. On April 13, 1913 the General Assembly of the State of Ohio passed a law authorizing the Board of Trustees to carry on extension work in connection with any department of the Ohio State University.\(^{14}\) The College of Agriculture had a broad extension program and now the College of Engineering wished to follow.

There was also a call for a greater development of the research and graduate education programs of the University. McPherson worked diligently to "sell" the idea of the value of research work to the general public and the decision-makers in the State. In part his arguments were financial. He said: "research pays, even considered from the standpoint of dollars and cents alone" and pointed out as proof the existence of 500 laboratories of industrial research and development in the country. He viewed the role of research at the University to be in the area of fundamental rather than applied research he felt that it was necessary for the strength and well-being of the country.\(^{15}\)

---

\(^{13}\)Board of Trustees, *Fifty-Second Annual Report, 1921-22*, p. 8.

These two factors, the increasing enrollment especially at the lower levels and the desire of the faculty to move in the direction of research and graduate education, which led to greater specialization and new programs of study, led to the question of which, if either, should have priority in a situation of limited financial resources. President Thompson became increasing critical of what he saw to be an improper balance between the two areas. Prior to the war he had expressed the opinion that the "elementary and foundation courses must always be provided." "They should be taught by experienced teachers if we are to lay proper foundations for advanced work, exact scholarship and rapid progress in the fields of higher learning." "In view of limitations of teachers and money that must inevitably be felt as the years proceed the question of limitations, must, in my opinion, be faced with serious and intelligent earnestness." While expressing an understanding of the desire of teachers to do attractive and alluring work and the necessity for time to be given competent men for scholarship he saw a problem of proper balance "between the time and energy to be given to the absolutely necessary foundation courses and the highly desirable advanced courses." He felt that some limit should be set to new course offerings.\(^{16}\)

\(^{16}\) *University Faculty,* "Faculty Records, 1916-17," p. 8.
Development of Conflict

President Thompson saw the conflict between the needs of instruction and scholarship increasing after the war. Exacerbating the situation was an inflation and subsequent concern for salaries on the part of the faculty. In April of 1919 the Faculty requested no additions to the teaching staff unless of unusual importance, with the object of increasing salaries. On October 2, 1919, President Thompson pointed out that there were too many small classes, in all 205 classes of five students or less. He expressed surprise to discover in how many departments there were four or more men whose teaching hours averaged from four to six hours. He saw a need to justify work in order to justify salary increases.

At a meeting of the Graduate Council held on April 28, 1920 it was recommended that those members of the staff who had unusual research should have their teaching loads reduced, while those who were strictly teachers should have their teaching loads increased by a corresponding amount.

About the same time President Thompson drew attention to reports that the students were being "obviously ill-advised by University authorities." There was also a problem of widespread cheating and on June 3, 1920 a committee to investigate the problem reported.

17 University Faculty, "Faculty Records, 1919-20," p. 6.
18 Ibid., p. 119.
19 Ibid., p. 151.
20 Ibid., p. 10.
While the committee attributed part of the problem to the "turbulent conditions of the outside world in getting back from a state of war to a peace basis", it found the following conditions contributed to the problem:

(1) the conduct of examinations had been lax due to inadequate supervision due in part to the application of methods which were perhaps suitable to small sections to the large and impersonal groups.

(2) the problems of providing instruction and the extremities to which the university had been driven to provide it had resulted in inadequate and unorganized instruction. In multi-sectional courses there was little attempt at coordination. There was evidence that many professors gave little thought to framing their questions. There were infrequent midterms and recitations and students complained that everything depended upon the final examination.\(^{21}\)

In 1921 President Thompson complained about the ploy employed by many departments of using the increased enrollments in the elementary courses as an excuse for adding new staff and then adding more advanced courses, which utilized the new staff people and necessitated the luring of more staff for the elementary work.

\(^{21}\)Ibid., p. 169.
He stated:

The request is granted. The following year new courses of an advanced character are proposed from the department and adopted by the Faculty. This is done on the theory that no additional instruction will be required. The next step is that incoming freshman or freshman and sophomores, as the case may be, brings another crowded condition and more instruction for freshman is called for, to be followed by more advanced courses being offered and this to be followed again with renewed requests for instruction for freshman. 22

He called for the departments to "keep in mind that its instruction covers a certain range of elementary, advanced, and graduate courses" and that it is "necessary, therefore, with the resources in hand, so to distribute this instruction as to make reasonable provisions for all three grades." 23

It wasn't that President Thompson was against advanced work and investigation. He recommended that the Faculty and the Board of Trustees recognize and approve the difference between teaching and investigation and that an adjustment of duties within the departments be made in that it was possible to assign men from time to time to either function. 24 What he was against was what he felt was a lack

22 University Faculty, "Faculty Records, 1921-22," p. 80.
23 Ibid., p. 82.
24 Ibid., p. 87.
of consideration of the overall needs of the University. He felt that the faculty was often operating more for the expansion and betterment of their own individual department or discipline and that this was often to the detriment of the University as a whole, especially in the area of the foundation courses.25

The Situation in the Department of Chemistry

The factors of increased enrollment, congestion in the elementary sections and expansion of upper division and graduate programs also occurred in the Department of Chemistry. In 1919 there was severe congestion in the elementary courses.26 The enrollment in the elementary courses in Autumn, 1916-1917 was 1012. By 1919-20 it was 1996, although it fell to 1400 the following year. At the same time the enrollment in all of the other courses in the Department went from 822 students to 901 in 1919-20. The enrollment of graduate students also increased from 55 majors in chemistry out of a total of 391 graduate students in 1916-17 to 96 graduate students in chemistry out of a total of 536 in 1925-26.27 There were a number of additions to the staff in the department during this period primarily to provide instruction in specialized subjects. In 1919 Edward Mack, Jr. was

26University Faculty, "Faculty Records, 1919-20", p. 10.
27Board of Trustees, Forty-Seventh Annual Report, 1916-17, p. 40; Fifty-Sixth Annual Report, 1925-26, p. 88.
given charge of the work in physical chemistry. In 1920 Wesley G. France was appointed head of the Division of Colloid Chemistry. In 1921 William Henderson was appointed Dean of the College of Liberal Arts. He continued in that capacity until 1927 when he resigned to devote his full time effort to the department. The most substantial increase in staff was in the junior staff. Between 1916 and 1924 the senior staff increased from 7 active members to 11, while during the same period the number of assistants, graduate assistants, and student assistants increased from 20 to about 50. The junior staff increase was needed to meet the increased enrollments in the elementary and service courses. Although the new members of the senior staff often taught recitation classes, the expansion in the senior staff was primarily for the purpose of providing new courses and programs of study. The increased number of students in the elementary courses was due to the fact that they were not only required in many courses of study but chemistry was also the most elected science by the students in the College of Arts. The popularity was due in part to the degree of organization and lecturing ability brought to the program by William L. Evans.

---

28 McPherson, "History of The Chemistry Department", p. 647.
29 Board of Trustees, Fiftieth Annual Report, 1919-20, p. 86.
The graduate program of the department was also strong. It has been seen that a significant fraction of the graduate student body was enrolled in chemistry. This was no doubt due in part to the requirement of junior staff in the elementary courses and the resulting support that this afforded graduate students. In 1925-26 the University employed 127 assistants, 80 graduate assistants, and 52 student assistants and readers.30 The chemistry department had 13 full-time and 3 part-time assistants, 31 graduate assistants, and 6 student assistants.31

Almost 40 per cent of all the graduate assistants at the university were employed by the department and over 25 per cent of the total of assistants and graduate assistants. A large fraction of the graduate degrees awarded by the institution were in chemistry. By 1922 29 of the 67 Ph.D. degrees granted by the University since its founding were in chemistry.32 In 1924 President Thompson described the graduate work in the Department as unusually well organized and that the university enjoyed the services of competent men whose experience with graduate students was highly satisfactory and that the students promptly found important places in universities and colleges as well as industry.33

30 Board of Trustees, Fifty-Sixth Annual Report, 1925-26, p. 9.
31 Ibid., p. 170.
33 Board of Trustees, Fifty-Fifth Annual Report, 1924-25, p. 21.
The large increase in enrollment and the expansion of the graduate program of the Department after the war resulted in crowded conditions in the Chemistry facilities. President Thompson described the conditions:

The situation in Chemistry is suggested when it is known that the registration last year in this subject was 3043 and is larger for the present year. The Freshman laboratory is the first large problem since all engineering students, all agricultural students, all home economics students, all pre-medical students, all veterinary students and all pharmacy students are required to take the Elementary Freshman Chemistry. Other Freshman may elect the subject. Every possible shift has been made to accommodate the increasing numbers. One wing of the Barracks was converted into a temporary laboratory - a good makeshift but not a satisfactory permanent provision. The advanced courses are usually crowded due to the increasing size of the Freshman class and the rapidly developing interest in the various applications of chemistry to industry and the increasing numbers going into curricula where chemistry is necessary.

The following table will show the comparative provisions made for Chemistry in several universities in the middle west:

<table>
<thead>
<tr>
<th>University</th>
<th>Date Constructed</th>
<th>Original Cost in Dollars</th>
<th>Floor Space Fq. Ft.</th>
<th>Total Freshman</th>
<th>Floor Space Per Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indiana........</td>
<td>1916</td>
<td>480,200</td>
<td>164,288</td>
<td>3299</td>
<td>1973</td>
</tr>
<tr>
<td>Minnesota.......</td>
<td>1916</td>
<td>405,000</td>
<td>90,000</td>
<td>2095</td>
<td>1650</td>
</tr>
<tr>
<td>Michigan.......</td>
<td>1909</td>
<td>305,000</td>
<td>120,000</td>
<td>3197</td>
<td>1602</td>
</tr>
<tr>
<td>Wisconsin.......</td>
<td>1913</td>
<td>201,754</td>
<td>107,000</td>
<td>2447</td>
<td>1305</td>
</tr>
<tr>
<td>Cincinnati.......</td>
<td>1916</td>
<td>250,000</td>
<td>54,000</td>
<td>960</td>
<td>332</td>
</tr>
<tr>
<td>Ohio State......</td>
<td>1905</td>
<td>110,367</td>
<td>42,000</td>
<td>3043</td>
<td>2057</td>
</tr>
</tbody>
</table>
These facts speak for themselves. There should be no hesitation in making at least a standard provision for the Ohio students who are asking the University for the privilege of studying Chemistry. The estimate for the additional unit is $220,000.34

The President's call for a new chemistry building was met when a new laboratory was authorized by the General Assembly. The first section was built in 1924 and the building was completed in 1929. This is the present McPherson Laboratory and at that time it provided accommodations for 3000 students.35

**The Freshman Problem**

In the University the movement toward graduate education, research, and specialization was seen by many to be occurring at the expense of the broader purposes of education. In 1923-24 President Thompson wrote the following comments on what he felt was occurring in higher education:

> It is a matter of great satisfaction to state in this report that the administrative officers in the colleges of the Ohio State University are cordially supported by the Faculties in the effort to keep the colleges abreast with the spirit of the times and with the best ideals in the fields of education represented by these colleges. If any criticism were made of the modern college organization, it probably might be that the administration was more solicitous about education in its broader aspect than the Faculties themselves. In universities where departmentalization and specialization have been given large opportunity there is a growing tendency to forget the unity of education and to relate the departments and the

---


35 McPherson, "History of The Chemistry Department", p. 647.
specialists to each other in such way as to make a contribution such as specialists and departments are competent to render. There seems oftentimes to be a large amount of unutilized resources. The student himself may not be alert to his opportunity. The professor may not be keen as to his responsibility. Individuality of activity rather than co-operative education tends to express itself. 36

He criticized what he felt to be overemphasis on research, often of a marginal nature, at the expense of superior teaching. He said:

The tendency to increase the number of persons having the rank of professor is very strong. It is perhaps too strong for the welfare of the University. The teaching body becomes out of proportion when so many persons are promoted. Furthermore the very decided tendency of persons with the rank of professor to find reasons for light teaching schedules under the guise of research is a decided evil. If we may rely upon the testimony of apparently competent persons elsewhere, it would be safe to say that not over one-third of the teachers of the colleges of the country are capable of any important research work. It would hardly be true, however, that these same persons could not develop into very useful and important members of the Faculty through superior teaching. There is a revival at present of the importance of teaching in the universities of the country which may attract attention and furnish a basis on which the salary of an important teacher may be as high as that of an important research man, and perhaps higher than that of a third rate research professor. It is quite natural that persons giving their lives to university work should expect within a reasonable period to receive the rank of professor. It will be a better day when that recognition comes as freely for superior

36 Board of Trustees, Fifty-Fourth Annual Report, 1923-24, p. 11-12.
teaching as it now comes for alleged research. It is quite obvious that the large number of men and women engaged in the University Faculties throughout the country would have a difficult task in justifying promotions for a majority of them on the ground of important research. There is room for reform in this matter in which I trust the Ohio State University will not be a laggard. 37

President Thompson, however, had a great deal of faith in the Faculties ability to correct any disorientation in the University. He said:

We may trust the Faculties of the country to correct their own errors in due time. Experience still holds sway as the greatest of teachers. Colleges and college organizations are not altogether unresponsive to the dictates and suggestions of experience. The hope for the future, therefore, lies in a free opportunity for educational experimentation and a sane attitude of mind on the part of College Faculties toward these experiments. A little more study on the part of Faculties in this great field would probably improve the college as an opportunity for education as much as any other one thing that could be suggested. 38

These themes were taken up by President Rightmire, who, in his Annual Communication to the Faculty of October 14, 1926, pointed to a lack of coherence and unity in the University and to a somewhat neglectful attitude toward the freshman student as the individual colleges and departments followed their own specialized pursuits. He pointed to evidence for poor preparation and counseling given to the freshman student and the resulting poor scholastic results. A study of the freshman in the College of Arts in 1925-26 indicated the following:

37 Board of Trustees, Fifty-Third Annual Report, 1922-23, p. 6.

38 Ibid., p. 11.
Of a total of 896 students; eleven per cent dropped out their first quarter, twenty-one per cent more dropped out their second quarter and of the remaining students more than thirty-three per cent averaged less than 1.5, more than forty-three per cent averaged less than 1.7, and more than forty-eight per cent averaged less than 1.8 which was the average required for graduation.\textsuperscript{39}

President Rightmire stated that these "results seem to indicate that many students ought not to have come at all, or that the University was at fault in its educational methods, or that a mistake was made in choosing the work."\textsuperscript{40} He further expressed the feeling that the situation was "rendered acute by the rumored attitude of the legislature here and there toward State Universities, prompted by the considerations of the very large and constantly increasing revenues required for University maintenance."\textsuperscript{41} He described this as the "freshman problem" and referred to it as the "most fundamental question which University educators are facing today."\textsuperscript{42}

\textsuperscript{39}University Faculty,"Faculty Records, 1926-27," p. 186

\textsuperscript{40}University Faculty,"Faculty Records, 1926-27," p. 182

\textsuperscript{41}\textit{Ibid.}, p. 178.

\textsuperscript{42}\textit{Ibid.}, p. 179.
William Henderson, Dean of the College of Arts, attributed a portion of the problem of poor scholarship to crowded classes beyond the possibility of effective teaching; to the fact that the elementary courses were often in the hands of young and inexperienced teachers, and to the fact that even experienced teachers become indifferent and uninspiring.43

President Rightmire was of the opinion that the inexperienced freshman needed a determined effort on the part of the institution to meet their needs. He expressed this to the Faculty:

But today at your pleasure I should like to think with the members of this Faculty with whom I have had most delightful associations for the past 24 years, of the freshmen students. This is a matter which directly affects seven of our colleges, and indirectly but nevertheless quite materially, the three strictly professional colleges. About one-third of our student body is composed of the freshmen; they come here ordinarily from the high schools of the state, and for the great majority it is their first experience away from home. They are inexperienced in college life; they have never before met such a wealth of courses of study from which they are required in their wisdom to make selections, they are unfamiliar with the methods of teaching employed in some lines of work, and also with the methods of study generally required. The fact that they are here in most cases warrant for the belief that they are here with an eagerness about the work and are hopeful and expectant, and really believe they are engaged in a great venture. They are therefore in a position to call for sympathy and patience and a determined effort to understand them and their viewpoints and their needs. There is no mistaking the fact that the work of the college

43Board of Trustees, Fifty-Second Annual Report, 1921-22, p. 89.
teacher calls for a very large expression of his human interest in dealing with these freshmen. So far as possible these young people should receive the most intelligence, attention and the most accomplished expression of the teacher's art; so far as possible they should fall into the hands only of experienced, patient, and sympathetic teachers, who will understand that for the most part they are still children, amendable to guidance and inspiration, and that in many cases they are diamonds in the rough and the polishing process for many of them may be rather slow. Perhaps this is the attitude taken by most teachers, but yet from a number of quarters the remark is heard that the teaching received by the freshmen in a State University should be subjected to investigation and appraisement. Of such great importance is a freshman in a University that many careful studies have been made in recent years of his fate in college work and there has been much constructive thought and writing about him; and because of developments found in his college life the investigation has been directed to his high school career and his home life, experiences. This freshman problem is the most fundamental question which University educators are facing today.44

President Rightmire went on to discuss some of the proposals and charges which had been put forth both locally and nationally in reference to this "freshman problem". He pointed to the need to educate the public to the purposes of the University so as to help them make better decisions as to who should pursue a college education. He called for:

(1) Intelligence testing of elementary and high school students to be used to advise parents as to a career choice for students.

(2) An orientation program for entering students at the University to be called Freshman Week.

(3) The use of placement examinations as a basis for advising students entering the University.

(4) The sectioning of students in each class of freshman subjects on the basis of an examination during the first class period.

44 University Faculty, "Faculty Records, 1926-27", p. 179.
He also felt that there was a need to repeal the open admission policy of the University and this had been proposed in the General Assembly because of the high cost of higher education and the high freshman attrition. He expressed the feeling on the part of many that the problem was not just with the student but also with the situation in the University. He spoke of the many charges made against the University which included the feeling that the large classes and mass education practiced by the University led to a loss of the human touch in instruction, that the large number of specialized courses diverted too much effort from the introductory courses, that there had been a deflection of money and resources into the rapid expansion of the graduate program, that much of the human wreakage was due to the organization and methods used by the University, and that the University was turning out uneducated people because so little attention was given to humanizing or broadly cultural fields of study. Rightmire pointed out that the problem of the freshman and the Graduate School were vitally connected and a "study of one of these elements cannot be entirely comprehensive unless it includes a relating study of all the elements." He proposed that serious consideration of a Junior College structure was of pressing importance.45

Two avenues were taken to meet these problems of specialization and poor scholarship. The first was the movement toward a greater emphasis on general education. President Rightmire commented on the general education idea by pointing to "a growing conviction on the part of educators that the free elective system has gone to an extreme and that more

system and unity must characterize the curriculum." These ideas resulted in some additional restrictions being placed upon unlimited electives and the provision for comprehensive and general courses to familiarize all graduates of the institution with the fundamental concepts of various areas of human intellectual endeavor. One of these survey courses was conducted by William Henderson and concerned itself with the development of modern science.

The other avenue was the creation of a committee by the Faculty to study the President's communication regarding the "freshman problem." That committee, of which William L. Evans was a member, summarized some of the problems outlined by the president as follows:

The character and preparation of freshmen students; facts relating to freshmen failures and elimination; proposed methods of selecting students and guiding freshmen both prior to their admission to the University and in the selection of their courses after admission; methods of instruction in freshmen classes and the proper allocation of teachers and courses in graduate and undergraduate years; the curriculum of the first years in the university; college organization and the freshman problem.

The Committee felt that the task assigned was too large so it recommended that a series of committees be established to study the various problems.

These committees were:

1. **Committee on the Problem of Entering Students**
   This committee would be asked to gather data upon the character and preparation of freshmen entering the University and the bearing of these data upon entrance requirements and scholastic success.

---

47 Board of Trustees, *Fifty-Sixth Annual Report, 1925-26*, p. 42.
48 Board of Trustees, *Fifty-Seventh Annual Report, 1926-27*, p. 73.
49 University Faculty, "Faculty Reports, 1926-27", p. 40.
Committee on Student Guidance

Such a committee would ascertain what facilities in the way of student guidance already exist on the campus; and these might better be coordinated and improved and additional policies and instrumentalities are advisable in the light of the conditions revealed.

Committee on Social Conditions Affecting the Student Body

This committee would survey the student body from the social, economic, health and recreational standpoint.

Committee on Instruction and Methods of Teaching

This committee would gather information regarding problems of instruction and methods of teaching quite specifically mentioned in the President's Address.

Committee on Student Progress

This committee would ascertain facts regarding such matters as student failures, elimination from the university, and their causes, and indicate the bearing of the facts revealed upon existing rules, student programs, etc.

Committee on the Supply of Upper Classmen

This committee would investigate the character and preparation of students received from other colleges in the state and the possibility of controlling and guiding students in matters of transfer within the university.

Committee on Student Scholarship made the following recommendations.

In large classes where two or more sections meet the same hour it is recommended that two or possibly three groups be organized, via honor and ordinary groups; honor, average and poor groups, -- each group to be dealt with, as regards content and method of instruction, in such a way as to attain the highest level of individual accomplishment. Provision should be made for transfer during the term from one group to another. It should be clear that the student's grade is not predetermined by his assignment to a section.

In small sections where sectioning on the basis of ability is not possible, it is recommended that upper students be accorded such privilege as may be best fitted to develop their initiative and mental capacities to the utmost.
2. Owing to budget limitations there is an ever-present danger in large elementary courses of seriously inferior instruction; in certain courses three-fifths or more of the student's classroom contacts may be with immature, ill-informed and insufficiently supervised quizmasters. Every effort should be made to improve this situation.

3. The grading system needs improvement, not so much in structure as in administration. There is a widespread feeling among students that A, B, C, D, and E have entirely different values as among departments, courses and individual instructors. This variance in what should be a common measure, like a fluctuating money standard saps confidence and leads to indifference, unthrift and a sense of injustice. Deans and departments can do much to remedy this evil. It is possible that a standing committee of the faculty should be constituted, as in some universities, to watch the figures and advise with departments and instructors on apparent diversity of standards.

4. We recommend that all colleges consider the advisability of adopting some device for the recognition of superior achievement analogous to the degrees 'with honors' and degrees 'with distinction in special subjects' now granted in the college of Arts, Philosophy and Science, and the Juris Doctor degree of the Law College.

5. 'Honors' courses should be arranged, mainly for seniors, or 'Minor Problems' courses such as now exist in chemistry, psychology and other departments. These give opportunity for independent study, not in classroom but under close individual supervision, the amount of credit as well as the grade varying according to the individual's achievement.
6. In case of students of exceptionally high quality the beginning senior should be encouraged to arrange a program of work, partly in 'Honors' courses, whereby he might qualify for both the bachelor's and master's degrees on the completion of twelve quarters. This might win suitable persons to the pursuit of graduate work, initiate them betimes in its processes, and eventually guard some excellent students from the danger of what is done by their inferior competitors, whereas in this year their work should be the most fruitful of all. Each case would need to be dealt with individually by college committee and graduate council.

7. Honorary societies should be encouraged, with election of students during their college courses. 'Professional' societies and departmental clubs that feature scholarship might be helped to promote intellectual activity and to stimulate the intellectual comradeship of the better students. They should have the intimate sympathetic assistance of the faculty members concerned.51

It can be seen that this committee was primarily concerned with the superior student and the promotion and recognition of his achievements. In order to accomplish its intended goals the Central Committee on the Freshman Problem recommended the establishment of a Junior Division.52 This recommendation was not met with complete enthusiasm. However, the Committee did find reasonable agreement among the various colleges on a few important points:

51 Ibid., p. 68-69.

52 The Ohio State University Faculty Central Committee on the Freshman Problem, "Report on a Proposed Junior Division of the University", May 31, 1927, p. 34-37.
1. That the character of the student body in the first two years of the University is such as to call for rather distinctive treatment.

2. That the needs of the students in these two years are not being sufficiently provided for under present conditions.

3. That at the present time the proposed junior division of the University at large should not be approved.

4. That some agency should be devised in the University charged with responsibility for establishing more intimate cooperation between the various colleges, and coordinating activity in the solution of common problems.

5. That agencies should be developed and created within the several colleges which will effect.

On the basis of these points of agreement the Central Committee made the following recommendations:

I. That the University Faculty recognizes that (a) the improvement of teaching, and (b) the cultivation of an atmosphere of scholarship among the student body in the University is primarily, especially, and ultimately a departmental problem, and that each department should continue to study and improve its teaching methods, and make every effort to organize a corps of masterful teachers.

II. That the University Faculty recommended for the consideration of the Colleges of Agriculture, Arts, Commerce and Administration, Education and Engineering the plan of organization on the basis of Junior and Senior divisions within these colleges. It likewise recommends that these colleges consider the advisability of adopting a selective principle of admission into their Senior divisions.

53 University Faculty, "Faculty Records, 1927-28", p. 121-122.
III. That the Board of Trustees authorize in the Colleges of Agriculture, Arts, Commerce and Administration, Education, and Engineering the creation of the office of Junior Dean, with the duty of advising with Freshman and Sophomore students concerning their courses and offering them guidance in the determination of the University work which they wish to pursue. In addition, it is suggested that the Junior Dean do some teaching.

IV. That a Junior Council of the University, organized under the chairmanship of the President be constituted, consisting of the Junior Deans and additional members selected from the University faculty at large by the President.

V. That said Junior Council be charged with the duty of studying all matters common, or what might be common, to the several colleges pertaining to (a) the instruction and (b) the guidance of Freshmen and Sophomores and to report their findings to the proper authorities. The following are some of the matters which might well engage the attention of the Junior Council.—

(1) Ascertaining as soon as possible the desire of the student with regard to his curriculum of study and advising him as to the best sequence of courses to reach that end.

(2) Studying the university record, high school record, intelligence record, health records and other available data regarding students, with a view to advising with students regarding their future status in the University.

(3) Cooperating with all departments interested in gathering and coordinating data which will enable departments to program students on the basis of ability, and to organize special sections for superior students, honor students and the like. (Towards this end, there should be gathered and made available for general use data bearing upon intelligence records, health records, university records, high school records,
and other matters. Likewise, it is particularly important to establish cooperative arrangements with secondary schools that will make possible an intelligent understanding of students upon their entrance at the University.)

(4) Providing for the needs of superior students both by devising ways of accelerating their progress, through enriching the curriculum for these students.

(5) Instituting where possible remedial instruction for the deserving and excusably slow or retarded students with a view to reducing with the limits of reasonableness the present percentage of elimination.

(6) Stimulating organizations of students and others which shall foster intellectual interests both of a curricular and extra-curricular character.

(7) Supplying students with information and advice in the way of educational and professional opportunities.

(8) Providing through appropriate courses, departments, or agencies for information and guidance relating to physical and mental hygiene.

(9) Considering recommendations for improvement in courses and curricula open to freshman and sophomore students and recommending the same to the appropriate college faculty for action.54

These recommendations were adopted by the University Faculty. Rather than establishing a separate Junior College to handle lower division teaching, it divided a number of colleges into a junior and senior division. The office of Junior Dean was created, along with a Junior Council. Their powers, however, were primarily to study problems pertinent to the lower division and to report these findings to the

54 Board of Trustees, Fifty-Eighth Annual Report, 1927-28, p. 6.
proper authorities. The various departments still retained power over their elementary courses and the instruction at the junior level.

President Rightmire saw the purpose of the Junior Dean as "to individualize as far as possible the attention given to students at the time of their greatest inexperience and thereby arouse all the latent energy and unexpressed inclinations and determination to embark upon a successful educational experience."55

A great deal of the pressure for improvement in the area of lower division teaching was due to public pressure. In his report of 1928-29 President Rightmire gave an indication of that pressure when he reported extensively on the efforts being made by the Junior Deans in trying to improve freshman teaching and bring about greater contact and understanding between the faculty and the students. He stated that "our present University organization and methods are on trial, and we must answer not only whether a university can successfully care for 14,000 students annually, but also whether it can develop the procedures and vitalizing personal contacts required to assure the intelligent development of 3000 new students each year." He points to this as a "grave question" which "must be answered not only to our satisfaction but also to the satisfaction of the people of the State and especially the representatives of the people in the State legislature." He referred to the "criticism of increasing violence" which the University had experienced in the past

55Ibid., p. 6.
and the need to demonstrate that the institution could be both large and still give personal attention to the students.\footnote{Board of Trustees, \textit{Fifty-Ninth Annual Report, 1928-29}, p. 6-8.}

The University apparently convinced the General Assembly that it was working in this direction and that it needed additional revenues. After a trip to other campuses, Michigan and Illinois, by important members of the General Assembly, the appropriation of the University was increased by about one-third.\footnote{Ibid., p. 5.}

The responsibilities of the Junior Deans were rather vaguely defined. The Dean of the Arts College mentioned a difference of opinion as to whether the supervision of teaching, particular of the junior members of the staff, should be done by the Junior Deans or within the departments. He felt that "the administrative officials of the College should be vitally interested in good teaching" and "should be in constant touch with each department with reference to the teaching techniques, teaching facilities, and qualifications of the numbers of the teaching staff". He felt, however, that the immediate supervision should remain with the department.\footnote{Ibid., p. 69.}

\footnote{Board of Trustees, \textit{Fifty-Ninth Annual Report, 1928-29}, p. 6-8.}
\footnote{Ibid., p. 5.}
\footnote{Ibid., p. 69.}
The General Chemistry Division

The Department of Chemistry had, over the years, attempted to bring some degree of order and supervision into the General Chemistry Program. William L. Evans had been hired to supervise the work in general chemistry and was successful in systematizing the instruction. In 1919 the Dean of College of Arts pointed to "Freshman Chemistry" as an example which should be followed by other large departments. He noted that in this area "when several instructors are teaching sections of the same class the most experienced is made director of the course, and weekly meetings of the instructors are held, to the advantage of the younger and less experienced teachers". He claimed that this resulted in a greater degree of clearness of purpose, the selection of the most fruitful parts of the subject matter, personal interest in the student, and the development of good team work.\(^{59}\)

In 1925 the department was formally divided into a number of divisions for administrative purposes.\(^{60}\) These were the Divisions of General Chemistry, Analytical Chemistry, Organic Chemistry, Physical Chemistry, Colloid and Advanced Inorganic Chemistry, and the Graduate Division. The General Division was described as follows:

\(^{59}\) Board of Trustees, *Fiftieth Annual Report, 1919-20*, p. 75.

\(^{60}\) Board of Trustees, *Fifty-Sixth Annual Report, 1925-26*, p. 87.
The work of this division is embraced in three general courses: (1) an introductory course for students who have never studied chemistry; (2) a similar but more advanced course for those who have had a high school course in chemistry; and (3) an elementary course in quantitative analysis. The registration in these three courses for each quarter was as follows: Autumn, 1441; Winter, 1482; Spring, 921. These courses are repeated once each year, so that a student has two opportunities to complete the work offered. While these courses are introductory and arranged primarily for freshman, nevertheless nearly fifteen per cent of the enrollment consists of upperclassmen.

For the first time in a number of years, the laboratory work of the division is housed in one building, with ample facilities. This condition has made it possible to greatly increase the efficiency of the work.\(^{61}\)

In addition to the supervision of the younger instructors and the special division established for general chemistry, experienced teachers were, at least to some extent, involved in the teaching program. In addition to Evans, who was known as an inspiring teacher, both McPherson and Henderson maintained a close working relationship with the first year work, even teaching freshman recitation classes.\(^{62}\) These measures had their effect for there was enough of a spirit of interest and cooperation within the freshman program that the students in the Division of General Chemistry presented the Department with a sum of money "adequate for the purchase of a specially designed large bronze tablet" which was placed in the laboratories devoted to freshman chemistry

\(^{61}\)Ibid., p. 87

\(^{62}\)Board of Trustees, Fifty-Ninth Annual Report, 1928-29, p. 199.
commemorating its dedication to Edward W. Morley. This is not meant to imply that the chemistry program did not have problems similar to those discussed with the "freshman problem". In 1927-28 when requesting additional courses to the Council on Instruction, McPherson admitted that "the work of the Department of Chemistry has been rightly criticized because the courses were arranged only for students specializing in chemistry". He proposed a series of new courses designed for students who wished to take a limited amount of chemistry without specializing in it. These courses were not approved because of budget limitations.

Courses were also proposed by the Department which were in keeping with the General Education movement at the University. They were described as follows:

Chemistry ( ). Development and Nature of Scientific Ideas. Three credit hours. Autumn Quarter. Three meetings each week. Prerequisite, Junior or Senior Standing. Mr. Henderson.

This course is designed for those students who (sic) major study is not in the Sciences. Its purpose is to give such students a general view of the historical development of scientific ideas and to dwell upon the nature and validity of scientific hypothesis and theories from a scientific point of view.


65 Ibid., p. 1.
Chemistry ( ). Methods and Ideals of Science. Three credit hours. Spring Quarter. Three meetings each week. Prerequisite, Senior or graduate standing, and a major in science. (Students well advanced in a major in science at the end of their Junior year and supervisors of work in science are eligible.) Mr. Henderson.

This course is designed for advanced students in science or for those with a definite interest and attainment in Science. It aims at a review of the methods of science and the validity of its conclusions; the extension scientific methods in the social order, and the preparation and responsibilities of scientific workers.66

The reaction of the Chemistry Department and the Division of General Chemistry to the "freshman problem" was reported by McPherson in his departmental report for 1927-28:

CHEMISTRY

It may be said at once that the work of the year has not been marked by any outstanding happenings. Each member of the teaching staff has carried on his work faithfully and with a fine and sympathetic spirit, and the students have responded in a similar spirit. Taken as a whole, I am sure that the Department has had one of its most successful years in the history of the University.

Naturally the work has been somewhat handicapped because of the fact that the classes are scattered in different buildings. The Department is looking forward to the completion of the new building with great anticipation. There is no question but that the work can be made more effective when it is all centered in one building.

The Department has been fortunate in again having the full time of Professor William E. Henderson. He represents a field of work that is the greatest importance. His return has made it possible to stress the advanced inorganic and historial side of the work -- a step greatly to be desired.

The registration in the first-year courses of Chemistry amounted this year to approximately 1600. The work of each of these students is divided into three parts; namely, lecture, laboratory and quiz. To properly direct the work of such a large number is a task that only those can appreciate who have attempted it. The administration side of the work alone requires the ability to direct that is possessed by very few. Dr. William Lloyd Evans and his associates deserve the greatest praise for their untiring and cheerful efforts in making an outstanding success of this work.

In harmony with the general program of the University, the Division of General Chemistry has made an earnest effort to improve the instruction in the first-year classes. Last autumn during Freshman Week, all first-year students who expected to study Chemistry were required to take a "Placement Test". The results of this test were used, as far as possible, as a basis for segregating the students in accordance with their ability. While our experience has not been sufficiently extended as yet to judge of the value of these tests, Professor Evans and his associates are satisfied that they have sufficient value to warrant their continuance.

The Division has recognized for some time that the work could be greatly improved if more homework could be required. However, the limited assistance available made it impossible to examine weekly such large numbers of papers as this homework would require. This year, for the first time, President Rightmire gave the Department a sum of money sufficient to employ a number of "readers" and so make possible this increased amount of homework. As a result, the students received such thorough training in the solution of problems that, at the end of the year, they could readily solve all kinds of problems properly falling within the limits of first-year courses in Chemistry.
The students in General Chemistry are divided into two large groups. Those who have never had a course in high-school Chemistry are placed in one group, while students who have had such a course constitute the second group. It is always a very difficult problem to decide just what work should be assigned to this second group. For the past two years Professor Evans has given to this group a series of lectures on the "Nature of Matter". This year he was assisted by Professors McCaughey, Mack, and Alpheus Smith, representing other fields of allied work. Each student was then required to present a theme bearing on some phase of the general subject included in the lectures. The Department of English, represented by Professors Beck and Harbarger, cooperated in a very effective way. As a result, many of the themes handed in were of very high character. One of them, written by Miss Phoebe Arnold Paine, has been accepted for publication in the Journal of Chemical Education.

It will be recalled that last year the students in the Division presented to the University the sum of $280 to be used for designing and erecting one of the laboratories included in the New Chemical Building, a tablet to the memory of the late William Edwards Morley. With the approval of the Board of Trustees, this particular laboratory is hereafter to be designated as the Morley Laboratory, and it is believed that the students will consider it a distinct honor to be allowed to carry on work in a laboratory dedicated to so eminent a chemist. This year the class subscribed an equal sum for designing and constructing a similar table bearing the name of Joseph Priestley, and the laboratory in which this will be placed will hereafter be known as the Priestley Laboratory. The dedication of the individual laboratories to great outstanding chemists cannot fail to have a marked educational effect upon those who are privileged to work in these laboratories.

The William Edwards Morley Cup, which for a number of years has been presented by the local chapter of the Alpha Chi Sigma fraternity to the freshman student having the highest scholastic standing in first-year Chemistry, was awarded this year to Miss Phoebe Arnold Paine.
That the members of the instructional staff of the Division are alive in their effort to improve the teaching in the Division is shown by the fact that no less than seven different articles, coming from the Division, have either been published or accepted for publication during the year in the Journal of Chemical Education.

It may be noted that the freshmen laboratories in the New Chemistry Building are supplied with 1632 lockers. This year the registration ran to 1600. If the usual increase in registration continues, the locker capacity will be exceeded by next year.67

This was McPherson's last departmental report and the following year William L. Evans, the new department chairman submitted the report. The departmental reports of the following year included reports on the techniques of teaching used in the various departments as called for by President Rightmire. Professor Evans gave a good view of what was being done in the Department in the elementary courses, along with the feelings of Dr. Evans on the subject.68 In the report he proposed an "Ohio Plan" to constitute cultural courses in the physical sciences and other areas of intellectual endeavor. This plan involved cooperative teaching by men from various related disciplines in order to give the students an idea of the unity of knowledge. This was an outgrowth of an experiment in cooperative teaching that had been tried for several years in the Department of Chemistry. It involved a series of lectures which presented in an elementary manner the modern views as to the ultimate nature of matter. The topics and men teaching them for 1928-29 were:


68 Board of Trustees, Fifty-Ninth Annual Report, 1928-29, p. 199-203.
(a) The Periodic Law - Professor Evans
(b) The Discovery of Radium - Professor Evans
(c) Isotopes - Professor Evans
(d) The Structure of the Atom - Professor Day
(e) Evidence for the Existence of Molecules - Professor Mack
(f) The Collodial Particle - Professor Day
(g) Crystals - Professor McCaughey of Mineralogy
(h) Stars and Atoms - Professor Williams of Astronomy
(i) Matter and Energy - Professor Smith of Physics

Evans felt that the Departments of Physics, Astronomy, Crystallography, and Chemistry could develop a course in the physical sciences using this approach that would be stimulating to the students of the junior college years, who intended to major in the humanities. He felt that it "would lose all of its charm if it were finally placed in the hands of one man 'because one of its outstanding advantages to the boys and girls is the opportunity to hear the specialists themselves present their material,'" while showing them the continuity and difference between the various fields of learning.69

Professor Evans also expressed the desire that more members of the senior staff would aid in the recitation work in freshman chemistry, and indicated that several had expressed a willingness to cooperate the

69 Ibid., p. 199-200.
following year. He pointed out as an example the close relationship maintained by Dean McPherson and Professor Henderson with the freshman program by teaching recitation sections:

These splendid and inspiring teachers are full of helpfulness with the first year students. To have the Dean of the Graduate School and the former Dean of the Arts College teaching first year quiz classes in chemistry is a fact which makes one pause. As an illustration of Dean McPherson's enthusiasm, I recently found him in his classroom with a number of students about him - all of them earnestly engaged in discussing some points of chemistry. It was one o'clock. The class had been dismissed at twelve. The Dean and his pupils had forgotten their lunch.70

In this same report Professor Evans describes an experiment tried by Professor Henderson:

Dr. William E. Henderson tried the interesting and unique experiment of placing one quiz class entirely on its own responsibility. In this experiment he undertook to give all possible assistance but held no formal quiz and kept no record. The result is expressed in Dr. Henderson's own words: 'Almost the exact group average as in the total freshman class with the same average and failure. The prize winner for freshman chemistry was in this class. It is my opinion, worthwhile students will profit by this general treatment. Those who will never get on in college (of whom many enter here) will not respond.'71

The Department also began to offer first year chemistry on an accelerated basis in the Summer Quarter. The student could complete two quarters work in one quarter. Professor Evans also indicated that the Department had been experimenting with the use of "written exercises"

70Ibid., p. 206.
72Ibid.
as a teaching device. He wanted to make clear that these were given 
in the spirit of education rather than in the spirit of testing.

He described this experiment as follows:

(a) When the student presents himself for 
laboratory work, he is asked to solve either a 
small number of problems or to answer about five 
questions bearing upon the work immediately in 
hand. This takes about ten or fifteen minutes. 
At the end of the writing period the papers are 
collected and are immediately graded by the 
graduate assistants. These are returned to 
the students during the laboratory period. 
This affords an excellent opportunity for 
student and instructor to sit down and go 
over any difficulties or misunderstandings 
in the student's mind with reference to the 
material immediately in hand. The questions 
are so chosen that the grading is not a 
difficult task. This can be done quickly. 
May I also add that each graduate assistant 
makes a record of the grades thus attained. 
The advantages which this close personal contact 
possesses in these large classes must be very 
obvious to the President.

(b) For many years we have been doing the 
same thing in our weekly quiz work, but by reason 
of our one-hour period we are unable to return the 
papers graded until the next meeting of the class. 
May I say in this connection it has been the practice 
of those teaching first-year chemistry to return 
to the student all papers upon which he has done 
any written work for us. The only papers that are 
not returned to him are his final examination papers, 
which he may have for review only if he feels called 
upon to challenge his quarter's grading.

(c) As an illustration of the teaching value of 
a written exercise, may point out to the President 
that in the subject of "Valence and Reaction Writing" 
it has been our custom to give a series of written 
exercises extending over the period of a month. 
This means fifteen or twenty minutes taken out of 
each laboratory half day for eight successive times.
Filmed as received
without page(s) 154.
Unavailable for microfilming.

UNIVERSITY MICROFILMS.
The splendid feature of this plan is the possibility of developing these two topics slowly but very accurately. As pointed out above, we return the papers within the laboratory period and have a thorough discussion of the difficulties at that time while the student's mind is very much on the subject. By means of the "written exercise" we are endeavoring to attain as great a mental contact with the large groups of first-year work as it is possible to do. With very much smaller groups this is an end that is not difficult to obtain. But our constant thought is to devise ways and means to reach the student personally.

(d) Two years ago we began to experiment with the values that might render themselves in the practice which is commonly known in the lower grades as "homework". The difficulty at this point was the matter of grading these exercises. We were allotted a small sum of money for readers. This experiment proved to be very helpful indeed. It was discontinued this last year, by reason of a lack of funds. However, for the next academic year it will be again put into operation. Dr. Day, Dr. Fernelius, and I myself are looking forward with much anticipation to a full year of this sort of thing on the part of the students.\(^{72}\)

The Department had also embarked upon a program to increase the amount of contact between the student and the senior staff. Professor Evans pointed to the lasting value that such contacts could have and that this was an advantage those students attending smaller colleges often enjoy. The Department extended invitations to the advanced freshman students to make laboratory contacts with members of the senior staff. The contact essentially involved laboratory assistance in the research laboratories of the Department. Twenty-five replies were received by

\(^{72}\text{Ibid.}, \ p. \ 201.\)
Evans who indicated only a few were placed during the Summer Quarter because of the lateness of the invitations. He felt that the program was successful and that the professional staff was very enthusiastic "over the opportunities for material helpfulness which the plan presents." 73 However it seems that much of the reaction to the crisis over the "freshman problem" was rather short-lived. The Chemistry Department report of the following year makes no mention of General Chemistry in any way. The program of laboratory contact between the professors and students never progressed very far. Although the Junior Deans were initially concerned with the improvement of teaching at the elementary level and pushed for the development of a general college structure so as to execute more control over this area, gradually the Junior Deans devoted more and more time to student personnel programs and less to the teaching program. Although the "freshman problem" improved the lower division education by giving more consideration to the entering student the basic trend toward specialization and an emphasis on graduate education and research continued and often progress in this area was seen as coming at the expense of the more elementary programs. It is noteworthy that even William McPherson, who certainly was in favor of graduate education and research, in his address to the American Chemical Society on being inaugurated as its President in 1930 felt it necessary to comment:

Interest in research should not diminish interest in teaching. It seems to me that our appreciation of

73 Ibid., p. 203.
the teacher is declining. One of the most difficult positions to fill in our departments of chemistry today, and to my mind one of the most important, is that which has to do with guiding the instruction of the students in the introductory course. Men adequately training in chemistry more and more seem to feel it beneath their dignity to have anything to do with the beginner, apparently forgetful of the fact that the great chemists of all time regarded the introductory course as being of so much importance that they were that they were unwilling to trust it to any one other than themselves.74

In this address McPherson also discussed the relationship between chemistry and education. In discussing the causes of the growth in appreciation for chemistry he mentioned the "great industrial development" which created a demand for trained chemists and was reflected in the greater number of students majoring in chemistry, along with the war, which "made vivid the possibilities of our science and led to an increased willingness to provide adequate facilities for its study." Professor McPherson felt that teachers of chemistry had been slow to recognize that a new view was being developed regarding education and the educative process. He pointed out that the world was rapidly changing and that there had been a rapid growth in the knowledge of science and its practical application and a desire by many to share in its advantages. This was reflected in increased enrollments and interest in education. This appreciation of the value of education was accompanied by concern for the methods and aims of education. He felt that chemists had been somewhat fearful that emphasis on the method of teaching might cause a

neglection of the importance of content and stifle the "spirit of mastery and investigation". But "members of the instructional staff of the departments of chemistry in colleges and universities are not only chemists, but teachers as well" and as such they should be concerned with the theory and aims of education. McPherson himself felt that method should involve "an ordering of classroom and laboratory as will develop in the student alertness, mastery, self-guidance and the research spirit". He felt that it was especially essential to chemistry teachers to be concerned with the aims of education since chemistry was "taking its place as one of the fundamental subjects included in the liberal arts curriculum of our college". Concerning whether chemistry viewed as a liberal art should be taught differently than the course arranged for specialists he expressed the fear that a separate course would "resolve itself into a collection of facts pertaining to chemistry, interesting undoubtedly, but serving neither the aims of education nor those of science - enjoyable bedtime reading but out of place in serious college work". But he also felt that the technical course might miss many of the educational and cultural values to be desired. He stated that the best course would be designed to meet the needs of both groups; that it should provide "fundamental knowledge of the science of chemistry by stressing acquaintance with fundamental laws and principles; also habits of clear-thinking and independent judgment such as contribute to constructive ability and ultimately to good living as well". He expressed the thought
that "it is the development of the scientific method or habit of thought which is the scientist's fundamental contribution to the educative process."

He outlined his thoughts on what the character of the general chemistry course should be:

(1) The subject must be about chemistry, sound, fundamental chemistry. By this he meant to avoid overemphasis on facts and striking experiments which "blind the student to the principles of chemistry." He believed that popular chemistry was being overstressed "to the destruction of the science itself."

(2) The central aim of the course should be the development of the scientific habit of thought in the minds of the students.

(3) The end of trained thinking is scientific control. By this he felt that the teacher should guide his students to an understanding that the methods learned in the course apply not only to the solution of problems in chemistry or science, but in other areas as well.

(4) The teacher should use the course to teach regard for the natural law. McPherson felt that "if our nation is to prosper and civilization to advance, we must take into account these fundamental laws and work patiently and intelligently in light of them."

(5) The teacher should stress the oneness of all sciences. He criticized the artificial barriers that had been erected around the branches of science and praised the tendency to unite existing departments into a single unit.
(6) Many of the topics of chemistry can be used to illustrate the development of the scientific method of study or some other important principle.

(7) This history of chemistry should play an important part in the general course. He felt that by providing history in the course, the students would avoid the feeling that chemistry reached "its present state of development in some miraculous way"; that it could be used to illustrate the development of the scientific method of study; and that it could favorably influence the student's attitude toward life.75

It can be seen that McPherson and Evans both were concerned with the quality of education at the introductory level and both were involved with innovative approaches to the education at that level. Evans proposed what was essentially a team teaching approach to providing a broad cultural course in chemistry to non-science majors. McPherson was concerned that the theories of education be applied to chemistry. Yet often that younger men showed little interest in the concerns of freshman education, preferring instead to pursue their specialized areas. The examples of McPherson and Evans did attract to the Chemistry Department a number of good chemists who did not feel it was beneath their dignity to be involved with the introductory program and the introductory program was maintained at a high level.

75Ibid.
CHAPTER V

THE DAY, FERNELIUS, QUILL ERA

The Organization of the General Chemistry Division

It seems that The Chemistry Department did not come under as much criticism as some other departments regarding the freshman courses in large measure due to the efforts of William L. Evans. Professor Evans was a noted teacher who, with the help of Jesse Day, organized the general chemistry program so that it ran efficiently and fairly. Evans and Day saw to it that everyone associated with the program did their jobs. The students always knew what was expected of them and the junior staff was closely supervised. Professor Evans and the other lecturers communicated with the staff by means of weekly meetings and notices.\(^1\) The interest shown by Evans and Day, along with the participation of McPherson and Henderson undoubtedly made a favorable impression on the students even if the subject matter was difficult. The organizational structure that Evans and Day built for general chemistry was expanded and modified as the enrollment in the courses increased. In 1922 Evans designated certain

\(^1\) The Ohio State University, Department of Chemistry, "Record of General Chemistry Notices, 1922-23", The Chemistry Department Archives.
people to be in charge of the major divisions of the work in general chemistry. Mr. C. D. Looker was appointed to assist Evans with all matters pertaining to general chemistry. His duties involved the following:

(a) arrangements for mid quarter examinations.
(b) arrangements for all written work in Quiz Classes and laboratory.
(c) conferences with laboratory section chiefs and quiz section chiefs.
(d) distribution of examination and quiz lists.
(e) records in the offices of the Division of General Chemistry.
(f) assignment of grading responsibilities.
(g) approval of the use of the office clerk for typing, mimeographing, etc.

Chief Assistants were appointed in the large courses to be responsible for the laboratory organization, assignments and the presence of chemicals and apparatus.²

The ability of Professor Evans in administering the program in General Chemistry was later noted by President Rightmire who described Evans' administration of General Chemistry as providing a "record of

²Ibid.
which the university was proud and which could be equalled only by the highest type of work".\(^3\)

Much of the credit must go to Jesse Day for the high degree of organization in the program. When Evans was appointed chairman of the Department he gave over the direct management of the General Chemistry Division to Day, although Evans continued to teach elementary courses himself. In Jesse Day's twenty years with the department his principal interest was freshman chemistry. In the early 1930's, when he was formally administering the Division, there were from 1500-1800 freshman chemistry students. During his final years, immediately prior to his early death on April 19, 1935, he was interested in the development of programs for students who entered the university with a high proficiency in chemistry.\(^4\) After his untimely death Professor W. Conrad Fernelius assumed the direction of the General Chemistry Division.\(^5\)

Professor Fernelius had come to the Ohio State University in 1928. He was closely involved with the freshman program and he provides an excellent description of the operation of the Division:

I shall never forget my arrival in Columbus in September of 1928. My train arrived in the late evening leaving no time for anything other than getting me to a hotel for a good night's rest. I was met at the station by Dr. William Lloyd Evans with his abundance of wavy gray hair and Dr. Jesse E. Day with a peculiar cloth hat and a big cigar.

\(^3\)Board of Trustees, *Sixty-Fifth Annual Reports, 1934-35*, p. 6.

\(^4\)University Faculty, "Faculty Records, 1935-36", p. 80.

They welcomed me, took me to the Fort Hayes Hotel (where they had made a reservation for me), and told me to take the streetcar to the University in the morning.

Their directions were adequate and I found my way to the chemistry building the next morning with very little difficulty. The building which later became known as McPherson Laboratory was in the process of building. Only the north half was completed. The office of freshman chemistry was occupied by the secretary, Roxanna Roder, for the General Chemistry group and the various files related to the general chemistry courses. In addition to Roxie's desk there were other desks for assistant secretaries employed on a temporary basis, and for the special assistants. Also there was a long table at the south end of the room for general use - even for the grading of exams only where a few assistants were involved. The adjoining offices were occupied by Professors Evans and Day. My office was the corner one across the hall. The Departmental office was temporarily located in the big end-room that was to become the museum (later it was converted into a graduate assistants' room where each graduate assistant had a desk).

The year was one of transition. In the interim between the hiring and arrival on the scene, Professor McPherson had relinquished the Chairmanship of the Department to devote full-time to the Deanship of the Graduate School and Professor Evans assumed the Chairmanship but remained Director of General Chemistry. Two people formerly associated with general chemistry, Looker and O'Donnell, had left at the end of the previous year. So my indoctrination came fast. I assisted Professor Evans (including some of the lectures) in the 401, 402, 403 sequence for those with no previous training in chemistry while Professor Day did the same for the 411, 412, 413 sequence.

Assuming some responsibility in a course was a new experience for me. My own introductory course at Carnegie Tech was not spectacular. Holmes' textbook was used and the laboratory involved very little that I had not done in high school. At Stanford I had assisted in the laboratory and learned a good
deal from the more quantitative experiments of
the Lattimer and Bray manual introduced by
Huggins, then a new member of the staff. I
also had a little experience with discussion
sessions. Since this experience with discussions
served as my practice teaching (I acquired a total
of 15 quarter hours credit in education), I perhaps
viewed it in a somewhat different light than just
as a job. At any rate, I was truly impressed at
what was being done at Ohio State.

The enrollments in both sequences of courses
was large. This meant multiple lecture sections.
Dr. Evans gave most of the lectures but Dr. Day
and I had at least one lecture section each quarter.
The distribution of effort for the two courses was
two hours of lecture, one of recitation, and two
sessions of laboratory each three hours long.
There were five laboratory combinations (M-W, A.M.
(The eleven o'clock and four o'clock (except
Thursday) were reserved for graduate courses.)
The rule was that everyone involved tried to keep
the course on the assigned topics for the week.
(Every student was given a schedule at the first
class meeting). Thus a new person like myself was
expected to audit one of Dr. Evans' set of lectures
and cover the same material. To accomplish the same
thing among graduate assistants, we had regular
meetings each week. At three o'clock on Thursday
afternoon the lecturers met with the special
assistants (more about these later) and reviewed
in detail the work for the following week in an
effort to make sure that no detail was omitted.
At four o'clock all assistants and teaching faculty
met. The first half hour was taken up with some
special topic about teaching - either subject
matter and difficulties of presentation or tech­
niques of teachings (conducting recitations, etc.,).
During the second half hours, the entire group
broke up into two sections depending upon the course
in which they were assisting. The full details of the
week coming up were discussed including what materials
that were to be available in the chemistry stockroom
(also more about this later). This lock step probably
didn't appeal to some of the participants but no one
questioned it just as no one questioned that the
McPherson and Henderson textbooks would be used. I
favored the arrangement because every student in a
given course received the same instruction and each
was graded in terms of the whole enrollment, not just a segment of it. Further, we developed some good teachers. Graduates of Ohio State were in responsible positions in general chemistry programs all over the country. Our graduates were sought for such positions. Of course, these people served as good recruiting agents for new graduate students.

There was another practice which made for uniformity and hence a better opportunity to compare all students in a given course on a uniform basis. This was giving all students a common mid-quarter examination. They were scheduled in the evening. Since there was no single room or set of rooms large enough to accommodate all of those taking a course, we would reserve rooms all over the campus. However, the same exam would be given and the same amount of time allowed for everyone. No one ever discovered a system for giving uniform final examinations. Here one had to prepare four examinations corresponding to the four lecture sections. However, we usually gave one of the exams twice but it was not always the last exam given which was the duplicate.

Grading of exams (usually the day following the evening when they were given) was a group affair. It was recognized that grading had precedence over everything but specific class or teaching assignments. To decrease the latter, the students were always excused from one laboratory in lieu of the extra time required for taking the mid-quarter exam. Hence the laboratories were available for grading sessions. We assembled at 8:00 a.m. and each assistant was assigned one question to grade (once again for uniformity of grading) and standards set in consultation with the instructor in charge of the course. The lines were so arranged that a paper passed in succession from one assistant to another. Often there would be two such grading lines. When any question arose about how to grade a particular paper, the matter was discussed with the person in charge and any decision communicated to any others grading that same question. Occasionally, it would be necessary to hunt back through a set of papers already graded to give equal treatment to those who might be affected by the decision. Often there would be a question which required more care than others in grading. In such cases, it might be necessary to
assign two people to that question in order to keep the flow of papers uniform. Was it a good system? I liked it. Assistants and faculty learned together. The esprit de corps was high.

The policy on making up a missed assignment was liberal. The University recognized that many students held jobs on which they were very much dependent. Hence, permission to give our evening exams was given on the basis that a person with a conflict would be given an opportunity to take the exam at another time. Such persons were requested to report to the General Chemistry Office well in advance of the time of the exam and state his reasons for missing the exam (usually by a note from his employer). Shortly after the evening exam, a daylight equivalent was given at a time convenient to all concerned.

Those teaching freshman chemistry were committed to the maximum enrichment conveniently possible. On initial contact with these courses, I was struck by the fact that each student received copies of the Journal of Chemical Education. Later on this was replaced by the Chemistry Leaflet.

I was impressed by the way in which most new developments in chemistry were introduced into the freshman courses. I had been introduced to the Bohr theory and Lewis atoms at Carnegie Tech. At Stanford we were inclined to feel that our neighbor to the northeast was a bit over zealous about explaining everything on the basis of electrons. I was a bit surprised to find that every freshman at Ohio State built from glass tubing, beads and cooper wire a Lewis model of some atom. During my section year at Ohio State when the south half of the new building was completed, a new experiment was initiated. When the time for the discussion of atomic structure came around, the routine was varied a good deal. Since one group of students was taking laboratory while another was in laboratory, the two sections could be combined readily by dismissing the laboratory for an hour. Thus, by repeating a lecture only once it was possible for everyone enrolled in a course to hear it. Also in this fashion the number of lectures
per week could be increased from two to four. Further, one didn't hesitate to ask his colleagues around the campus to join in for a good cause. So for two weeks the students were really exposed to the latest findings about atomic and molecular structure from chemists, physicists, philosophers or whoever had some contribution to make. I am not sure the understanding gained by the students justified the effort, but the staff and junior staff (for this is the way we designated our assistants) learned a great deal.

Across from the Office of General Chemistry was located the Office of the Laboratory Supply Stores. This unit of the University had overall responsibility for ordering supplies and equipment, for stocking the laboratory desks, for supplying chemicals and apparatus to individual students and staff members, etc. However, anything checked out there was an outright purchase or a long term loan. The Laboratory Supply Stores had branches in most of the buildings devoted to laboratory courses. For courses like General Chemistry and Organic Chemistry requiring specific reagents on certain days and the loan of water baths, etc, for short periods of time, the Department maintained its own stockrooms. These provided excellent opportunities to support additional graduate students. Normally these included those who could not qualify for assistantships or who applied too late. These people developed real expertise in effectively handling large numbers of students. If there was a handout on a particular week, the stockroom staff would have a copy on the workbench of each student when he came to class. In order to avoid any holdup at the balances at the start of laboratory period, the students would be supplied with a weighed sample of starting material. (Since students generally did not complete the experiment at the same time, there was no problem at the balances if the student did the final weighing. In general, laboratory notebooks were printed at the OSU print shop, assembled and stapled by the stockroom staff, and distributed to each student. Thus one could revise such items yearly and yet get them to the students at minimum cost. In the summer, the stockroom staff did a complete clean-up, repainting,
etc. of the laboratories, ring stands, pneumatic troughs, etc. as well as a variety of other tasks in anticipation of the approaching academic year. Often this necessitated hiring extra persons during the summer, but what better way to aid an assistant for whom no other job was available? The objectives were providing high quality instruction with the saving of time for instructor and student at minimum cost. I think we did quite well. . . .

. . . The Division kept very completed files. The roll cards for both recitation and laboratory were kept in racks in the office. A summary for the quarter was transferred to master cards for each student together with performance on mid-quarter exams. These master cards showed the full record for the three quarters of general chemistry. Thus, when a request for information about the standing of a student came to the office, the information could be given without having to consult the individual instructors. Each year a copy of every examination, of every handout to the student, and of every announcement to student or junior staff was posted in a scrapbook.

In the winter quarter there was always a repeat section - what is called in many places a trailer section. This was never under Dr. Evans' charge but always assigned to one of the junior members of the instructional staff. He was free to run this as he saw fit. Most of us had a few experiments we wanted to try. Some of our changes were complete flops but some of them would be incorporated into the big course in the following year. The experimentation was particularly true in the qualitative analysis portion of the courses. In the mainline courses we used a small qualitative analysis book written (I think) by McPherson. It was satisfactory for the actual laboratory operations but was almost devoid of any theory of qualitative analysis or detailed treatment of reactions. We had to supplement it a good deal. Between trailer sections and summer courses, most of the commonly used texts were given a trial run. Later on Evans and Day wrote their own book on qualitative analysis. It served our purposes satisfactorily and was well received generally.

I had never heard of freshman week or advanced standing until I came to Ohio State. I was greatly impressed by the effort to orient the new students
to the University and a new life style. I literally
couldn't believe that an outstanding high school
student could get advanced standing in English,
foreign languages, mathematics, chemistry and/or
biology, etc. We used the examination given to
all students presenting entrance credit in
chemistry to determine how much they had benefited
by the high school course. For those who did very
poorly we recommended that they take not the 411-
413 sequence but the 401-3 sequence where the pace
at the start was slower and no assumptions were
made about the adequacy of previous training.

Advanced standing in chemistry produced some
problems. When good performance in high school
was recognized by granting one quarter credit, we
found the students at a considerable handicap
when they entered the second quarter. At first
we recommended that they audit the lectures of
the first quarter. Then we decided that the only
solution was a special course devoted entirely to
these students. We called this the proficiency
course. Our experiences have been described in
some detail: Day, J. Chem. Educ. 12, 166-8 (1935);
Fernelius, Quill and Evans, ibid. 14, 427-33
(1937).6

Although the Department did not come under as much criticism
in the area of undergraduate teaching, various changes were instituted
in the programs to attempt to improve the quality of undergraduate
teaching. Some of the changes were encouraged by the junior deans,
while others resulted from the significant changes in chemical
knowledge that had occurred in the prior part of the century. Knowl­
dge of atomic structure had been expanded by the Bohr Theory and
quantum mechanics. These changes began to be introduced into the
elementary chemistry curriculum, first in the course for the better

6Letter from W. Conrad Fernelius to Robert W. Batchellor
concerning the General Chemistry Program, 1928-1940, University of
students and shortly for all the general chemistry students. These changes required the attaining of new knowledge on the part of some of the older faculty members and it is likely that the substantial number of younger men who entered the department in these years encouraged the introduction of the more modern theory. As we have seen, Fernelius was surprised to find that most of the new developments in chemistry had been introduced into the freshman course. The feasibility of doing this rested on the better preparation students were receiving in science in the high schools.

The junior deans encouraged the use of interview sections as a method to encourage the faculty to keep in touch with the feelings and attitudes of the students. These interviews involved a meeting between the student and his instructor. The students responded enthusiastically to these sessions. The Chemistry Department cooperated with this program and encouraged its students and faculty to engage in interviews. In 1931 during the week of February 9-14 it was reported that 290 freshman came into the chemistry office for interviews. This program apparently died out rather rapidly as several members of the department active during that time have no

7 A. B. Garrett, private interview, Columbus, Ohio, December, 1972.
8 Letter from W. Conrad Fernelius.
recolletion of the program. Perhaps the onset of the depression with its financial pinch and the necessity of larger classes and teaching loads contributed to its demise. Certainly an interview of even a short length with each student in a class of 200 or 300 would be time consuming.

Another area of reaction to the "Freshman Problem" was provision for entering students who were already proficient in a field of study. In 1931-32 the College of Arts and Sciences adopted the principle that if an entering student was able to demonstrate proficiency in a subject he could gain credit, up to a certain maximum, for that subject. The Chemistry Department had been experimenting with placement examinations and sectioning on the basis of the results since 1926. A placement examination was used as the major factor in deciding whether a student was qualified to take a more advanced first year course. For a number of years students had been sectioned into Chemistry 401-403 or 411-413 on the basis of whether they presented high school chemistry as an entrance credit. The candidates for 411-413 were given the placement examination to see if they qualified for the more advanced elementary course. In 1929 it was decided that the same examination could be used for selecting those students with an entrance unit of chemistry who were capable of completing three quarters of first year chemistry in two quarters.

11Board of Trustees, Sixty-Second Annual Report, 1931-32, p. 11.
or who might be excused from the first quarter's work. Neither of these procedures for handling the proficiency students was entirely satisfactory. The provision for completing three quarters work in two quarters met with administrative difficulties because certain colleges were reluctant to give three quarters credit for two quarters work. The complete skipping of 411 resulted in the proficiency student being at a handicap in the 412 course when competing with students who had just completed 411. This handicap was not fully resolved by allowing the proficiency students to audit the 411 lectures.

The proficiency examination was broadened in the early 1930's to include both a formal written examination over textual material and a laboratory examination. One of the reasons the laboratory examination was added was because the high schools were finding it necessary to curtail laboratory work which had been expanded prior to 1930. This was as a result of the depression. Since the elementary course emphasized laboratory work, the members of the department apparently felt that there should be a manipulative aspect to the proficiency examination. In 1930-31 the following procedure was used to section the general chemistry students: The assignment to


13 Fernelius, Quill and Evans, "Experiences", p. 427.

14 Ibid.
either 401-403 or 411-413 was initially made on the basis of whether the student offered chemistry as an entrance unit. A placement test was then given to the candidates for the 411 course. About 20 of the lowest students were demoted to the 401 course, the 70 highest (out of about 800) were given a special course covering three quarters work in two quarters. The students in 401 were also classified into two groups. This was on the basis of their work in the first few days of class. In the later courses of each sequence the students were grouped according to their work the previous quarter.\(^\text{15}\) A number of faculty in addition to Evans and Day became interested in the problem of selecting proficiency students. These men included W. Conrad Fernelius, Lawrence L. Quill and Alfred B. Garrett.

After the death of Jesse Day the process of selecting proficiency students was modified somewhat by Fernelius and Quill. They felt the need for a special proficiency examination in addition to the regular placement examination since they were trying to select not only the better students, but were also giving credit for a course. The placement examination was used as a preliminary rating device and the students who ranked highest (down to the 89th percentile) and those students who expressly requested the privilege were given a proficiency examination. This proficiency examination consisted of both a written section and a laboratory section. The written section was comprehensive and designed to be the equivalent of a somewhat difficult 411 final examination. Students who satisfactorily

\(^{15}\)University Faculty, "Faculty Records, 1930-31", p. 90.
passed the proficiency test were admitted into a special proficiency course. Thus there was a special 412 and 413 course for proficiency students. These courses were not identical to the regular 412 and 413 courses because they attempted to supply those deficiencies which the students might have by missing the 411 course. The members of the Department felt that while these students had familiarity with the subject matter in the 411 course, they lacked the following:

(a) a realization of the significance of the theories of chemistry,

(b) an understanding of the real significance of the scientific method,

(c) a familiarity with quantitative experimentation.

The proficiency course included a review of the 411 course material in a mature fashion so as to give practice to the use of general concepts and theories.  

The studies of Fernelius and Quill were not limited simply to the proficiency tests, but they were also concerned with the performance of the students and the basis of grading such sections. These men also examined the professional interests of the proficiency student. The study of proficiency students continued in the Department for twenty years. During the war it was necessary to include the proficiency students with the regular 412 and 413 students, but after the

16 Fernelius, Quill, and Evans, "Experiences", p. 427-428.
war a special section was again established. It was necessary to change the procedure for identifying proficiency students after the war because of the large number of students entering the university. The initial placement examination and the laboratory portion of the proficiency examination were dropped and the students chosen on the basis of a short arithmetic test, a chemistry test over the first quarter of work, and The Ohio State University Intelligence Test. The arithmetic test was an outgrowth of a study by A. B. Garrett and H. Fawcett which showed that the results in the elementary chemistry courses were closely correlated with the ability of the students in arithmetic. These studies also led to an attempt to upgrade the quality of mathematics education in the schools of Ohio.

In 1932-33 the administrative problems with proficiency were resolved when the University Faculty adopted the general policy of granting entrance credit upon the successful passing of a regular course examination. In 1935-36 proficiency credit was allowed for up to 30 quarter credit hours.

Another concern of the Junior Deans was the improvement of examinations in the various lower division courses. One of the

18Ibid., p. 25.
20Fernelius, Quill and Evans, "Experiences", p. 427.
21University Faculty, "Faculty Record, 1935-36", p. 64.
principal criticisms of the teaching at the freshman level had been the unfairness of the examinations. About the same time the subject of examination technique became the focus of national attention. The General Education Board made available $500,000 for a ten year study of examination methods.\textsuperscript{22} A portion of this work was done at the Ohio State University. Dr. R. W. Tyler of the Bureau of Educational Research developed methods and techniques to test the ability of students to make and test hypotheses, to handle scientific instruments, and to apply the scientific method. Dr. Tyler worked with a number of departments in applying his techniques to various elementary courses, especially with Botany, Zoology, and Home Economics. He did some work with the Chemistry Department.\textsuperscript{23} This resulted in a change in the type of examinations which were given in the department during this time.\textsuperscript{24}

Dr. Fernelius and Quill were both instrumental in developing objective examinations for elementary chemistry in order to develop better testing procedures, to bring more consistency into the grading, and to handle efficiently the large number of students. In general, the Chemistry Department was selective in the changes that it intro-

\textsuperscript{22}Board of Trustees, \textit{Sixty-Second Annual Report, 1931-32}, p. 162.

\textsuperscript{23}\textit{Ibid.}, p. 162.

\textsuperscript{24}See the "Record of General Chemistry Notices" for this period for examples of examinations.
duced into its courses as a result of new developments in educational research and the basic methods and curriculum did not change appreciably.25

Attempts at a Broader Coordination of Elementary Courses

The coordination and supervision of the large elementary courses was also an area of concern to the junior deans. We have seen that McPherson anticipated this problem in 1905 with the appointment of Professor Evans as the supervisor of the general chemistry courses. In the late 1920's, with the concern over the "freshman problem", this practice became common in other departments with large lower division courses. The Dean of the College of Arts and Sciences in his report of 1932 described the position as follows:

There has been no formal action by the Faculty or Board of Trustees; the office and duties of the supervisor is one of the conventions of our university constitution. The supervisorship rests on understanding rather than formal legislation. Nevertheless, it is a significant and very useful institution. In all of the departments where there are large elementary courses one member of the staff is recognized as responsible for supervising the work of the corps of teachers and for developing a reasonably uniform method of instruction. There is no disposition to reduce the instructional work to a dead level of prescription; the initiative of the individual teacher must be carefully safeguarded. But there is much that can be done, and is being done, by the supervisor in the way of advice and suggestion that

is helpful. The supervisors in this college have occasional meetings under the chairmanship of the Junior Dean, where problems are discussed, and experiences exchanged. There is no doubt as to the stimulating effect that this organization is having on the work in this area.26

The Junior Deans felt that a more efficient method of coordinating the supervision of elementary courses was needed. They reported their feelings in 1932 as follows:

II. COORDINATION OF THE SUPERVISION OF JUNIOR AREA INSTRUCTION

We believe that there exists a similar need for coordinating the supervision of the Junior Area instruction. Under present arrangements department heads, supervisors, and the junior deans are all responsible for the development of improved instructional practices in the freshman and sophomore years. Much of importance has developed under this present plan of organization, but we feel a need of achieving a greater degree of coordination should be seriously studied.

We have in this connection no particular plan to propose. We have, however, a conviction that the present divided responsibility between department heads, supervisors, and junior deans inadequately provides for as rapid instructional development as we ought to expect. It may be that department heads, supervisors, and junior deans should constitute a council on the improvement of junior area instruction. It may be that a steering committee of this large group could successfully stimulate necessary development. It may be that there should be a standing committee of the faculty on the problem. There may, moreover, be other plans that have not come to our attention.

We are certain, however, that some plan should be evolved which will accelerate the improvement of University instruction especially for underclassmen.27

Developments within the College of Arts and Sciences gave the opportunity for a group of related departments to coordinate the administration of courses at the lower division level. In the Summer of 1932 a new curriculum was introduced in the College. This curriculum was closely related to the separation of the work into a junior and senior division. This separation resulted because of the need to provide differentiated instruction for freshmen and sophomores. The Central Committee on the Freshman Problem expressed one of the reasons for this need as follows:

Social conditions in America now make it possible for practically everyone to obtain education up to the limit of his mental ability. Our educational institutions are already crowded, and increasingly larger numbers are availing themselves of this opportunity every year. As a result of the most complex civilization which the world has ever known, the demands for diversified types of training are increasing quite as rapidly as the student numbers.

The traditional machinery for higher education, evolved originally to care for the scholarly-minded and the "gentlemanly professions", no longer serves to meet the demands for diversified training. Especially does it fall short of serving the needs of that increasingly large group who are unqualified by interest or aptitude to profit by a highly specialized type of education in any line of work.

Thus far our attempt to meet these demands for higher education for the masses by the use of traditional educational methods has resulted in a very

27Ibid., p. 168.
mixed and unsatisfactory program involving numerous educational makeshifts. Our present plan, for a large number of students, too often appears to lead nowhere except to one or more years spent in college.28

The work of the junior division of the College of Arts and Sciences was designed to not only provide a preparation for students to enter the senior division, but it was also to provide a general education for students who wished to enter professional schools or leave after two years. The student who satisfactorily completed the work of the junior division was to be granted a "Certificate in Liberal Studies".29

The new curriculum represented a reduction in the number of required courses so that the student would be better able to either pursue his area of interest or to broaden his general education. The major of the student could consist of 40 hours in an area of the student's interest. The major did not have to be in one department, but there could be an overlap of departments. The student was assigned a major advisor by the Dean of the College. The purpose was to avoid letting departmental boundaries be the basis of planning work in the major.30 A significant factor in the new order was the opportunity for departments in related fields to organize as a group.

With the approval of the Dean and Executive Committee this organization

28 Ibid., p. 169.
29 Ibid., p. 52.
30 Ibid., p. 53.
was to be given:

(1) the power of jurisdiction over all sequences of elementary courses by which the requirements of the junior division were to be met;
(2) supervision and standardization of proficiency tests;
(3) jurisdiction over all 600 level courses offered by the departments in the group; and
(4) direction of the work of students whose fields of concentration fell within the group.\(^{31}\)

This possibility was developed because it was felt that the department was too small and specialized and the College too large to administer these areas effectively. It was hoped that this feature would help to unify and synthesize the lower division work and eliminate the fragmentary character of the educational process. This device was experimental and voluntary. It did not meet with great acceptance on the part of some of the departments.

The press to effect some sort of separation of the more elementary curricula from the control of the specialized departments continued. On May 10, 1934 the University Faculty appointed a committee to consider "the introduction into the University program a group of courses especially designed to meet the needs of students who do

\(^{31}\textit{Ibid.}, p. 53\.)
not desire to follow the regular curricula or not capable of doing so through lack of preparation or native ability.\textsuperscript{32} This resulted from the feelings of President Rightmire and others that the university had a duty to provide higher education of some form for all Ohio students who desired it. He stated in his letter to the Committee:

Perhaps any General College organization should be rooted in the purpose of the University to carry out the mandate of the State given by statutes in the provision that every graduate of a first grade high school in Ohio is entitled to admission to the University. This evidently means that the University will exert itself to find out what each student can best undertake in the way of collegiate study and base its treatment of the students upon an intelligent appraisal of all their aptitudes and attitudes and circumstances having an appropriate bearing upon his University activity. Presumably the purpose in such a General College is not merely to point an easy way out of our exacting curricular requirements for the weaker or less tenacious student, but perhaps that will be a by-product. However, this is not sufficient purpose for such an organization and, if a purpose at all, it should be an incidental one, I am assuming. The genuine purpose is to accomplish for the student all that his mentality and personality will reasonably appreciate, and, short of a University course, we should do those things which will give him back to active society best equipped to carry the day's work there and make his contribution as a citizen—an understanding one, based upon his appreciation not only of opportunities but of responsibilities.\textsuperscript{33}

\textsuperscript{32}University Faculty, "Faculty Records, 1936-37", p. 22.

\textsuperscript{33}Ibid.
After a lengthy study of the implications of a general college, the committee arrived at the following conclusions:

1. There was not sufficient trustworthy data and educational experience available at the time to provide even partial answers to the questions being raised under the name of General College.

2. These questions are too fundamental to be answered by minor administrative adjustments and educational tinkering.

3. Only by carefully controlled and rigorously evaluated experiments can real progress be made in this direction.

They proposed, instead of a General College, an experimental program be established involving no more than 300 students in any one quarter and to extend over a period of no more than four years unless its extension was authorized by the University Faculty. This program was established in the College of Arts and Sciences with the students retaining registration in their usual college.

In 1940 a proposal to inaugurate a Division of General Education in the College of Arts and Sciences was made. In supporting the

---

34 Ibid., p. 106.
program Dean Stradley discussed the effectiveness of the experimental program in the College of Arts and Sciences and indicated that about 125 students were presently enrolled in that program and that 35 to 50 per cent of these students could be placed in the General Education program. He stressed the importance of being able to award a certificate for students finishing a two-year curriculum in General Education. However, the Council on Instruction was unanimously opposed to granting any certificate in this area.36

The following year a Program in General Education was established in the College of Arts and Sciences and administered by a University-wide Council on General Education. The courses in the program were taught by professors from various departments. This program was a unified two-year curriculum in General Studies, however the individual General Studies themselves could be taken as electives in the regular curricula. This program was separate from the exploratory program in the College of Arts and Sciences, which was designed more to provide guidance for students who needed specific educational and vocational guidance in their choice of college or curriculum. It was strictly terminal in that it provided no basis for specialized work. It was not intended to meet individual deficiencies of those students with limited preparation for the regular curricula; there were remedial and tutorial courses available for these students.37

36 Ibid., p. 53.
37 Board of Trustees, Seventy-First Annual Report, 1940-41, p. 30-31.
Thus we see that the attempts to meet the "freshman problem" were fragmented and no central coordinating unit developed to give a focus and unity to efforts in the area. The junior deans, the department chairman, the supervisors and many others were involved in the processes at the lower division level. Attempts to unify the area in a junior college organization were resisted. With the advent of the war the push in this area dissipated. In 1941-42 the course in General Studies in chemistry, Chemistry 441-442 was withdrawn because only seven students enrolled.\textsuperscript{38} In 1942-43 the title of Junior Dean was changed to Assistant Dean. The duties of the junior deans had become increasingly focused on counseling activities and less on curriculum and teaching. It was felt that the counseling services and various other student personnel services should be extended to all undergraduate students. The name of the Junior Council was changed to the Council on Student Personnel.\textsuperscript{39}

The provision for the elementary courses remained basically tied to the specialized departments of the university as one of their various functions. No core organization existed to promote their interests or to coordinate their activities independent from other interests and activities. The Policy Committee of the

\textsuperscript{38} The Ohio State University Faculty Council, "Faculty Council Minutes, 1942-43", Columbus, Ohio: The Ohio State University Archives, p. 103.

\textsuperscript{39} Ibid., p. 263.
University Faculty recognized some of the problems in this form of organization in providing for service courses:

For administrative purposes the University is typically organized into colleges, schools, and departments. This administrative organization must not be allowed to suggest a compartmental organization of educational activities and functions. The programs of colleges, schools, and departments supplement each other. A college, school, or department must have a core of characteristic functions, subject matter, programs, and policies. It may also serve other units of the University and interlock with other colleges, schools, departments, etc. It must be strong and self-reliant in its own rights but also prepared to co-operate and serve. Courses must, therefore, be thought of as falling into two categories--those characteristic of the interests of the students majoring in the department and those intended to serve students majoring in other departments. The provision of these service courses is a major responsibility for each department. Every possible effort should be made to make them meet the needs of the departments in which they are used as service courses. They should be organized and the staffs chosen with their effectiveness as service courses vividly in mind. The University Policy Committee is persuaded that there is need for further attention to these service courses to ensure that they are properly differentiated from courses which meet the needs of those specializing in a particular department.40

In order to provide for this aspect of university work the Committee recommended the following

(1) That the service work of a department always be assumed to be a responsibility commensurate with the responsibility for specialized work for majors in the department.

40University Faculty Council, "Minutes, 1942-43", p. 263.
(2) That service courses be thoroughly organized, planned, and taught by appropriately selected personnel.

(3) That instructors who teach service courses have recognition commensurate with that accorded instructors who teach in their field of major interest.

(4) That whenever such service courses are not adequate because of budgeting reasons, the department receiving the service should cooperate with the departments offering the service courses in urging administrative officers to provide an adequate budget to bring the service up to the standard devised.\(^4\)

**Effect of the Depression**

Shortly after 1930 the effects of the depression began to be felt by the University. In 1931 a variety of cut-backs were made.\(^4\) In 1929-30 the legislature had appropriated over $10,000,000 for the institution. In 1931 this was reduced by over one-fourth and more reductions came in 1932. In 1931 the teaching staff was reduced by 91 and all salaries over $3000 were reduced. By 1933-34 the legislative appropriation had fallen by about four million to just short of $6,000,000.\(^4\) This resulted in a major reduction in personnel, heavy teaching loads, larger class sizes, reduced administrative staff, a curtailment of research programs, and a third series of salary reductions.\(^4\) In 1933 there was a substantial reduction in the

\(^{41}\)Ibid., p. 264.


\(^{44}\)Ibid.
academic program:

- Courses withdrawn 337
- Courses in alternate years 69
- Courses consolidated 33
- Courses reduced in frequency 30

In 1934 the legislature increased the University's appropriation after an extensive study of the needs of the University. The appropriation of $7,155,600 passed both houses with little dissent. However the governor vetoed $1,266,500 of this appropriation. At the same time admissions were up 24 per cent or 1008 over the preceding year. This was attributed to federally subsidized employment of students, financial assistance by provision for cooperative dormitories, and renewed employment for the parents. By 1936-37 the total enrollment was up to 16,670 students and increasing. As a result of increasing enrollment in 1935-36 the Chemistry Department found it necessary to offer some of its freshman and sophomore level courses in two quarters rather than just one quarter each year.

---

45 Ibid.
46 Board of Trustees, Sixty-Fifth Annual Report, 1934-35, p. 15.
47 University Faculty Council, "Minutes, 1934-35", p. 164.
49 University Faculty Council, "Minutes, 1934-35", p. 223.
In 1937-38 the appropriation by the legislature to the University increased by over $1,000,000 to about $7,000,000. In the 1939-40 appropriation there was an increase of $371,000 over 1937-38. This was still over $2,500,000 below that of 1929-30 even though the enrollment had increased twenty-two per cent.

One of the results of the depression was to negate some of the advances that had been made as a result of reactions to the "Freshman Problem". President Rightmire wrote:

The size of class sections has been considerably increased in many departments of work; for five years the University made strenuous efforts to organize the classes into smaller sections so that the teacher and students would have a better opportunity for becoming acquainted and the personality and stimulus of the teacher might have individual outlet. Both the teaching and the learning were being greatly improved under this plan. The economics we have had to practice in the current year to a very great extent nullify the improvement in the dealings with students. In a large class the instructor finds it practically impossible even to know the names of all of his students, and the personal conferences and personal attention become a practical impossibility. Especially in the freshman year is such personal contact needed and highly beneficial, and the same condition prevails pretty largely in the sophomore year. Beyond that it is not such a vital matter although it is always important. Larger sections because there are fewer teachers have, therefore, necessarily resulted from the enforced economy program, and we are not being able to do for the first and second year students the kind of teaching and personal contact and counsel that we know to be most advantageous.

---

50 Board of Trustees, Sixty-Eighth Annual Report, 1937-38, p. 10.
51 Board of Trustees, Sixty-Ninth Annual Report, 1938-39, p. 11.
52 Ibid.
The load falling upon the teacher this year has been greater, and the customary reliefs obtained by having assistants, student assistants, and graduate assistants to help in the quiz work, in the grading of papers, and in the reading of reports, has not been available. Consequently the classroom load is heavier, and the teacher's office work in counseling with students and in reading reports and examination of manuscripts has greatly increased. Nor has the teacher in most cases been able to accomplish what the University should indispensably give in the way of collateral directions and counsel and in the guidance of students' reading. The teacher's work is not done when he steps out of the classroom; in fact it has just begun and much should be contributed by him in the way of conference and collateral advice and direction in the reading and study of the student outside the classroom. If this part of the work becomes impossible then the results which the student should expect are only partial. It is clear from the year's experience that additional help is needed to reinforce the teaching in these ways.\(^5\)

Another result was an increased stress on the public service that a university performs. The President in the annual report for 1935-36 stressed that the University performed three activities which served the state: teaching, research, and public service. He contended that teaching extended beyond the campus to all people of the state. He tried to counteract the feeling that the university was a "cloistered retreat for scholars and scientists dealing with abstractions and fumbling in futility and the infinite". He contended that

\(^{5}\)Board of Trustees, Sixty-Fourth Annual Report, 1933-34, p. 37.
public service was "inseparable from and interacting always with its teaching and research". An attempt was made to describe a cross-section of the public service activities of the institution. We see a determination on the part of the University to develop a greater degree of public support for its activities, undoubtedly with the hope that this support would be converted into a more favorable position with respect to financial support.

Various departments outlined their "public service" activities. The Chemistry Department's report was as follows:

In its research program the Department of Chemistry is essentially interested in fundamental chemical problems some of which have no immediate practical application. But many of the departmental investigations lead directly to public services, and among these in the recent past have been the following....

The University felt a need, partly as a result of the depression, of relating itself more closely with the greater society and its needs both present and future. There was seen to be a greater need to adapt the programs to the more immediate needs of the student in terms of the student's ability to cope with change in the future. The President commented as follows:

In thinking of the University, its status and its problems, it is well to remember that education is not static. A training which looks constantly to the past, regards as of basic importance

55 Ibid., p. 17-18.
only those happenings and causes and results upon human life which have long since spent their force, and never gets down to the active situations of the present, is of little worth. We cannot live in the past, nor can we prepare for the present and the future merely by knowing what has happened and how and why. Therefore we are under the constant necessity of bringing our educational program into direct contact with the life of the times. Certainly, we should become wise about the past so far as it may affect our conduct or our usefulness or our appreciation of nature and man in the present, but no university can rest its educational program upon the antique. It must treat human development and human progress as a seamless web. The educational program must be conditioned by ceaseless experiment and change; may we be quite sure that this goes steadily on in all college faculties?

Various devices are set up for testing the relevancy or the value of proposed changes, but no criterion is applied so constantly or so effectively as that of greater usefulness with reference to present conditions or practices or theories. We are all believers in the disciplines. We know that there are some fundamentals and that, to a certain extent, there may be training for training's sake; yet in the last analysis the University must establish itself in the minds of its people by endeavoring to fit its students more adequately for the life of the time and to cultivate an awareness and an alertness which will qualify them for leadership and the constant adjustment which living entails.

Therefore, there must be large elements in our educational training of today which fit the student to comprehend causes and trends, and give him a large degree of understanding of, and certainly some degree of control over, the forces which are now and which will be operating to work changes in the social order. We as teachers, therefore, must appreciate the necessity of a higher degree of alertness, must come to an understanding of the necessity of cooperation, and in the United States of America must inevitably try to understand democracy and the responsibilities and opportunities
of citizenship which necessarily attached thereto, and we must continually be adapting the University training for the professions, for the technologies, and for skills of various kinds, in accordance with present development in all these fields of human activity and the sound principles of progress and adaptation therein. We must also leave room for the creative or the inventive genius which changes all things, and our University curricula ought somewhere to take cognizance of these super-brains which appear from time to time among us.

All of this, if it says anything, cries out loudly that education must be a dynamic process, comprehending the forces which are constantly bending and shaping society and so determining the changing human scene.

Our responsibility as teachers and administrators is clearly to be aware of the life of the times, to shape our educational procedures in such fashion as to enable the student to take his place enthusiastically, purposefully, and effectively therein. This is the hope, more or less encapsulated of clear expression, entertained by every one of the constituents of the Ohio State University, and we must not grow weary in endeavoring to bring it to materialization.

As educators we must also realize that the professions and the technologies are calling for more adequately prepared persons and that the steady urge in these times is towards a greater preeducation for the professional or technical courses. This is keenly felt and we have steadily advanced from a prerequisite of secondary school training to one of increasing college training, and we cannot forget that many of the young men and women going into the professions and technologies today are already college graduates when they enter the study for the fields of activity. The college life of the student who expects to make a successful entrance into such fields has grown from three or four years in the total, to six, seven, eight, or even nine, years at the present time. They come late, therefore, into actual touch with life, so that the maturity as well as training is requisite. This trend is apparent. In many fields already the Doctor's degree is a sine qua non.56

The feeling for the need of preparing for competency in a profession and ability to adapt to changing conditions was reflected in the report of the College of Arts and Sciences by Dean Stradley. In this report Dean Stradley expresses a desire to maintain the liberal arts tradition and bring a closer integration into the curriculum, but also expresses "a more serious concern to relate the basic liberal studies to the demands and opportunities of social and professional life".57

In 1937 new curricula in Chemistry and Physics leading to the degree of Bachelor of Science were proposed. These curricula raised several questions in the Council on Instruction concerning the emphasis on technical courses, the limited opportunity to elect liberalizing courses, and the lack of a requirement in the biological sciences.58 The Council also expressed concern with the heavy schedules contemplated for freshman in the several curricula leading to the Bachelor of Science degree and requested that the College of Arts and Sciences study the possibility of reducing these schedules.59

Federal aid was made available during the depression and made possible some building, and considerable renovation of buildings. This aid, however, did not extend to the teaching force. Increasing enrollment coupled with lack of money created an emergency in

57Ibid., p. 37-38.
59Ibid., p. 11.
TABLE 3

COMPARATIVE INCOME AND ENROLLMENT FOR
THE PERIOD 1930-31 TO 1936-37

<table>
<thead>
<tr>
<th></th>
<th>30-31</th>
<th>31-32</th>
<th>32-33</th>
<th>33-34</th>
<th>34-35</th>
<th>35-36</th>
<th>36-37</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Enrollment (nearest hundred)</td>
<td>151</td>
<td>149</td>
<td>138</td>
<td>125</td>
<td>135</td>
<td>151</td>
<td>167</td>
</tr>
<tr>
<td>Graduate Enrollment (nearest hundred)</td>
<td>30</td>
<td>33</td>
<td>32</td>
<td>24</td>
<td>25</td>
<td>28</td>
<td>33</td>
</tr>
<tr>
<td>State Aid ($1000 omitted)</td>
<td>4799</td>
<td>4263</td>
<td>3377</td>
<td>2797</td>
<td>3092</td>
<td>2770</td>
<td>3338</td>
</tr>
<tr>
<td>Salaries for instruction ($1000 omitted)</td>
<td>2715</td>
<td>2603</td>
<td>2537</td>
<td>2113</td>
<td>2067</td>
<td>2290</td>
<td>2580</td>
</tr>
</tbody>
</table>

aData obtained from University Faculty Council, "Council Minutes, 1938-39", p. 49.
elementary teaching the hiring of new, permanent staff people was not possible. It can be seen from Table 3 that the salaries for instruction lost ground relative to enrollment during the Depression.

On May 1, 1938 the Committee on Urgent University Needs reported to the University. The committee pointed out that the faculty morale was at low ebb. This was attributed in part to the lack of full restoration of salary cuts received during the depression, the increased teaching load, the lack of recognition of research and graduate teaching.

The effect of the depression on the Department of Chemistry was somewhat ambiguous. The Department saw a substantial increase in its faculty during the years of the depression. After the first world war the faculty numbered seven: McPherson, Henderson, Foulk, Evans, Withrow, Boord, and Hollingsworth. Between 1919 and 1940 the following additions were made:

<table>
<thead>
<tr>
<th>Appointed</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>1919</td>
<td>Edward Mack, Jr.</td>
</tr>
<tr>
<td>1920</td>
<td>Wesley G. France</td>
</tr>
<tr>
<td>1923</td>
<td>Jesse Day</td>
</tr>
<tr>
<td></td>
<td>Cloyd D. Looker</td>
</tr>
</tbody>
</table>

---


61 University Faculty Council, "Minutes, 1938-39", p. 70.
While a number of these additions to the staff were made to keep pace with increased enrollments and to replace people who retired or left, a considerable amount of the expansion was due to the increasing research orientation of the Department along with the push for specialization in the discipline.

---

The Chemistry Department had a long research record encouraged by William McPherson, the Dean of the Graduate School, and Evans during his chairmanship. In 1933 President Rightmire in reporting on the publications of the faculty stated:

"In Chemistry the list is very long and shows a very active research spirit prevailing in that department. These writings cover research projects which spread themselves pretty generally over the field of chemistry; they deal also with matters of chemical education; there are many book reviews, etc.".63

In 1934-35 the Committee of the American Council on Education studied the graduate schools of the country. The Ohio State University ranked eleventh in the number of departments recommended as being thoroughly provided with outstanding scholars and equipment for graduate work (twenty-two departments). Four of the departments at Ohio State were starred as being especially outstanding in the field of graduate work: chemistry, education, entomology, and psychology.64

While the effect on the University as a whole by the depression was to substantially slow down research programs this effect was not as substantially felt in the Chemistry Department.65 In fact Caley reports that about 1930 there began a distinct change in the nature of the research being done in the Department.66

63 Board of Trustees, Sixty-Third Annual Report, 1932-33, p. 19.
65 Ibid., p. 30.
little support was received for research from the University or from outside sources. Beginning about 1930 and to an increasing extent after 1935 substantial research money was received from industry, foundations, and the federal government. Instead of individual professors and graduate students being involved in their own ideas, groups of investigators and graduate students worked on larger projects in conjunction with various supporting personnel. Often the subject matter of the project was specified and thus influenced by the sponsor.

In 1931, in conjunction with the organic division of the Department and Thomas Midgley, Jr., the co-discoverer of anti-knock gasoline, the Midgley Foundation was established with Albert L. Henne as Director of Research. This group investigated flourinated aliphatic hydrocarbons. The American Petroleum Institute initiated sponsorship of a project in 1938 which was to last for twenty-five years.

The federal government provided financial help which aided the research activities of the department during the 1930-40 period. Many students in the National Youth Administration's program were employed as laboratory assistants or in clerical roles on research projects in the Department. Various grants were received supporting research activities; for example, in 1935 Professor Melville Wolfrom received support in the area of synthesis of hydrocarbons.

67Ibid., p. 11.
The People Involved With the Division of General Chemistry

During this expansion the Department continued to have a strong teaching commitment in the Freshman area due to the leadership of Evans and Day and a number of other individuals who taught and performed administrative duties in the division of General Chemistry.

W. Conrad Fernelius was associated closely with the General Chemistry Division for a number of those years, both as a teacher and as the Head of the Division. He recalls that when he joined the Department McPherson and Henderson were only tangentially related to the program in freshman chemistry and he never did receive a full accounting of their relationship with the program. He was aware of their series of textbooks for he had used one in 1921 in high school. But both had been involved with their administrative duties when he arrived. When Henderson did return to the Department on a full-time basis, he taught inorganic chemistry, the history of chemistry, chemistry bibliography, and the general education course in science.68

Fernelius describes both individuals as having broad interests and a good understanding of people and education. In Fernelius' estimation McPherson was the better administrator, while Henderson was a more profound scholar. Henderson had more impact on Fernelius, perhaps because Fernelius was hired with the understanding that he

68Fernelius, letter, p. 11.
Filmed as received

without page(s) 202.

Unavailable for microfilming.

UNIVERSITY MICROFILMS.
would eventually take over Henderson's course of inorganic chemistry.

Fernelius described Evans as follows:

    Evans was a Welchman who, although born in this country, learned Welch before English. Some say that Welch are moody and have periods of pronounced ups and downs. Such was the case for W. L. Evans. Like a Welchman he deeply loved music. There were definitely good times and poor times to approach him. He would put himself tremendously for his department, but he would also give an individual a tongue lashing without mercy (not always deserved) on occasions. He enjoyed a joke but not if it was directed at him. He was a good churchman, but sometimes his language, just for the moment, betrayed his two years in the Army at Edgewood Arsenal. 69

Fernelius recalls that Evans had a profound interest in his freshman teaching. "To him freshman chemistry was a very serious matter and he gave everything he had to his lectures. No one of them was given without preparation. He learned to lecture before the days of amplification, and in truth need no public address system. When he lectured in the old chemistry building (new Derby Hall), it is said that he could be heard quite distinctly outside or in the next building if the window happened to be open. He dramatized and emphasized but he impressed his audience. He had a bit of the evangelist in him and the only unfavorable student comment to come my way was that one young lady insisted that she didn't come to chemistry to be 'preached at'. Even if one was so constituted that

69 Ibid., p. 12.
one couldn't imitate Evans' lecturing style, nevertheless one could learn much by observing him. Uncle Billy was known to students and faculty throughout the University.\textsuperscript{70}

Jesse E. Day received his doctorate at Ohio State in 1916 under the supervision of Evans. He was hired during the first world war to handle the teaching duties while various members of the Department were engaged in war related work off campus. After a time teaching at both Louisiana State and Wisconsin he was rehired in 1923. While Evans was the great lecturer and motivator of students, Jesse Day was the master of planning and detail. It was largely his efforts that resulted in the high degree of systematic organization in freshman chemistry. Day was not a great teacher and his lectures often fell flat. Fernelius felt that this was either as a result of Day's attempts to imitate the style of Evans or because of "his peculiar sense of humor which didn't always come across to the student". Day was anxious to be a great teacher in the mold of Evans, and he was deeply hurt when student evaluations would give him a lower rating than some of the graduate students. Day was, however, a great counselor of students and was at his best in face to face confrontations.

Although a great deal of the success of the freshman program was due to the efforts of Jesse Day, the relationship between Day and Evans tended to be onesided. Day always took his grade cards to

\textsuperscript{70}Ibid., p. 12-13.
Evans to look over before they were turned in to the registrar's office. Although Evans was never directly critical of Day, there was a feeling in the Department that Evans did not appreciate the true worth of Jesse Day and his contributions to the program.

The Division of General Chemistry served as a recruiting ground for the other Divisions of the Department. Even though a person was hired to teach in the Division, he had an affiliation with another Division because of his research interest and in most instances did some teaching in that Division. This arrangement allowed the Department and the individual to become familiar with one another, and eventually as the other divisions were able to absorb people they moved into those Divisions. Fernelius feels that while this arrangement had much to commend it, that it led to divided loyalties in some instances, and that as a result the "freshmen were the losers". 71

Melville L. Wolform and H. L. Johnston were hired in freshman teaching in 1929 but both moved quickly into other divisions on a full time basis. G. Bryant Bachman joined the freshman group in 1930 and was very active until he went with Eastman Kodak in 1936. Preston M. Harris was with the Division for a short time beginning in 1934.

The unexpected death of Jesse Day in 1935 "produced near pandemonium" in the general chemistry division. 72 At the same

72 Ibid.
time Edward Mack left to assume the chairmanship of the chemistry department at the University of North Carolina. Professor Evans immediately appointed a mature graduate student who had just completed his doctoral requirements as an instructor, J. W. Watt. He contacted Alfred B. Garrett and A. A. Alberts, former students in the Department, and offered them instructorships in the Department for the following year. A. A. Alberts appointment was apparently of short duration for he left after a short period; however, Garrett remained with the Department until his retirement in 1972 after a long career of service to the Department and the University.

Evans then began to consider a successor to Day to head the Division. One of the departments members approached about the position was Professor Fernelius. He had a good research program progressing and felt that he was established as an inorganic chemist and was happy with his situation. Lawrence Quill, then at Illinois, had expressed interest in the job and Fernelius left on his summer vacation in the West feeling that things had been pretty well settled and that Quill would be employed. Things did not quite work out that way, however, for Evans was concerned that there be a smooth transition in the Division. He requested that Fernelius accept the position of Head of the Division of General Chemistry for a three year period until Quill could become completely orientated to the procedures at Ohio State. Fernelius describes what occurred as follows:
My vacation calm was interrupted by a long letter (in long-hand so it could be mailed more quickly) from Professor Evans. In brief, he had employed Quill but wished me to take the position of Head of the Division for three years so that I could help him to become fully knowledgeable in the Ohio State set-up and procedures. It was not that someone from Illinois didn't know fully how to teach freshman, but there were many people with whom the person in charge of freshman chemistry should have good rapport (officials of the various colleges, director of the Laboratory Supply Stores, Registrar, Admissions Office, etc.,). I had considerable hesitancy because I didn't look forward to being as unhappy in the job as Jesse Day seemed to have been. My wife and I talked over a number of things, reached some conclusions and then spent most of the night drafting a reply. I asked for certain things in the conduct of the course and, if these were granted, agreed to take the responsibility for three years, during the first of which I would instruct Quill in the OSU ways; during the second we would co-direct and during the third would only inspect his decisions. All of my requests were accepted but one.73

Professor Fernelius made his requests because he wanted to avoid a situation similar to Jesse Day's in which Professor Evans approval was required of grades. He states:

Upon my return to Columbus, Dean Shepard called me to his office to talk about the new assignment. He said some nice things about the Department, the Division, and me. He expressed his pleasure over the arrangement and offered his full support. Then he asked me what was troubling me that wasn't stated specifically in my letter. I said that I was not going to be in charge of an organization which did all the work, made the decisions and then had to have someone else's O.K. on the grades to be given. The Dean said he

73Ibid., p. 15-16.
didn't blame me, that I didn't have to, and that if there was any difficulty to let him know. There was no difficulty.  

Professor Fernelius and Evans were able to establish a good working relationship. Professor Fernelius relates the following meeting with Evans which cleared the air between the two:

Near the end of that first year of my being in charge, I had occasion to review a few matters with Dr. Evans. I was fearful of the outcome but my proposals were readily accepted. Then Dr. Evans asked in a very nice way why I was so suspicious of him. I replied that I have no way to judge except through the reactions of others. I added my impressions had been incorrect. He thought a bit and said now he thought he understood why I had written as I did the previous summer. From then on there were no barriers to our dealings.

Fernelius recalls that there was a certain degree of status attached to certain office locations and that when he accepted the position his office was moved even over his objections.

One of the amusing things about assuming the responsibilities of directing the general chemistry program was which office went with the job. In the Spring of 1929 when the contractors completed the departmental office in the south half of the new building Dr. Evans moved from his temporary office (south side of the general chemistry office). Day then had to move from his office (north side of the general chemistry office) to the one previously occupied by Evans. The north office was occupied successively by Johnston (until he moved to the second floor), Bachman (until he left the department), and Quill. One of the matters which Dr. Evans mentioned in his long letter about the job (1935) was that I

\[74\text{Ibid.}\]
\[75\text{Ibid.}\]
would move to the south office. He proposed that this would be done for me prior to my return from vacation. Since I had glass lines mounted on racks which could be easily broken, I was not particularly happy about others doing the moving. I argued strongly against the move until I returned. Upon arrival I found everything in the new location located exactly as the mirror image of the previous location. If there had been any breakage, it had been repaired by the glassblower. Hanging on the rack was a dirty towel exactly as I had left it. Later on Dr. Evans confessed to having engineered this. Subsequently, Quill moved into the north office when it was vacated by Bachman and then into the south office when I moved to the second floor, whereas Garrett took over the north office when it was vacated by Quill (why a particular office exactly like the other should have been indicative of a higher position in the pecking order, I'll never know).76

The relationship that developed between Professor Fernelius and Professor Quill was excellent in terms of administering the Division. They had never met before, but at their first meeting they agreed that any of their disagreements would be handled in private and before others they would present a united front. Fernelius reports that this turned out to be unnecessary because they both thought so much alike. This led Evans to think that they had some sort of secret communication system. Fernelius writes:

Dr. Evans once confessed that he was very suspicious of us because he always got the same answer from each of us, even though he asked us the identical question at different places without the other being present. He suspected that we had some sort of surreptitious communication system. So he arranged a trap. He called me for my reaction

76 Ibid., p. 16-17.
and immediately called Quill. He knew that there was insufficient time for communication between us. Still he got identical answers. After that he gave up.77

It was fortunate that they worked so well together and their talents, along with those of A. B. Garrett were complementary.

Professor Fernelius described their working relationship as follows:

Quill was a good planning and detail man. Thus he contributed the very talents which J. E. Day possessed in such abundance. Further, Quill had experience with a different general chemistry organization and could bring to ours the best of that at Illinois. The writing of the laboratory manual to accompany the McPherson, Henderson, Fernelius, and Mack textbook was an interesting experience. Quill and I were good at critical review and the future consequences of something taught earlier. Garrett was a good initiator. So Garrett would come to work session with some manuscript copy which after some conversation Quill and I would proceed to revise. The end result was satisfying to all. We feel that we kept the teaching of freshmen chemistry at OSU at a high level.78

The management of the General Chemistry Division was a good experience in the eyes of Fernelius and it taught him and others many valuable management skills. He describes the job as follows:

The management of the General Chemistry Division was a big job and necessitated the exercise of real management skills. While it was possible for an instructor to coast and be carried along by the momentum of the organization, it was also possible for a person to make contributions which were felt far beyond the confines

77Ibid., p. 18.
78Ibid., p. 18-19.
of his own classes. Somehow nearly every year the Director, either directly or indirectly was exposed to most of the situations apt to be encountered by a manager. We had to learn how to deal with the assistant who was too tough on his students, the one who was too easy, and the one who was too rigid in judgments. We had to know the rules of safety and what to do in an emergency. We even got an introduction into legal matters when the manager of the freshman stockroom was put in jail for a minor offense, when a stockroom operator lost part of a toe because it was caught in the elevator, when we sought evidence other than circumstantial against a person whom we were certain had cheated on an examination, etc. The University was careful to conduct its business so that it was completely within the law and would therefore run very little risk of being taken to court. In this spirit, we were instructed to change one of our practices. At examinations, to simplify proctoring, we required students to place coats, books, etc., on the lecture desk and not pick them up until the exam had been turned in. One time a young lady claimed that her coat had been removed from the desk. No unclaimed coat remained when everyone had left. After the lapse of sufficient time for a person to inform Lost and Found or our office that a coat had been removed in error, the University bought the young lady a new coat. However, we were instructed henceforth to have students place clothing, etc., under their chairs and not on the lecture desk. We learned the value of teamwork. The Division had pride in the fact that no class was ever missed. Either the instructor found a substitute or reported into the Office so others could locate a substitute. Once Dr. Evans failed to appear on time for one of his lectures. The lecture assistant came dashing up to the third floor explaining his difficulty. I suggested he get a particular assistant to take over my class and I headed down the elevator organizing my lecture along the way. Some said it was the best lecture I ever gave. Later I learned that Dr. Evans did show up even if a little late. His comment was: "Fernie was doing such a good job I didn't see any need to disturb him".

In those days, we had three grades of assistants: graduate assistants with a stipend of $500, assistant at $750, and special assistant
at a higher figure which I don't recall. All positions carried remission of fees. The graduate assistants participated only in laboratory supervision; the assistants had recitation classes as well as laboratory supervision; the special assistants were the expediters to see that various actions were complete, on time, and to see that there was a minimum of slip-ups. Theirs was valuable experience both for positions in teaching or in some minor management. Some graduates of the department years after leaving the University said that their experience as assistants was the most valuable of all their training. I can agree. 79

It is noteworthy that all of the men who headed the Division of General Chemistry went on to enjoy success in various administrative capacities. Professor Evans became chairman of the Department and later served as president of the American Chemical Society. Professor Fernelius became the head of the departments of chemistry at Syracuse and later Penn State. Professor Quill became the department chairman at the University of Kentucky and later Michigan State. Professor Garrett was the department chairman at Ohio State and later vice president for research at that institution. He also served as president of the Division of Chemical Education of the American Chemical Society and was active in many other educational orientated organizations.

After 1939 Professor Fernelius devoted his time to inorganic chemistry and 1942 both he and Quill resigned to take other positions. They had kept the level of teaching in the freshman program at a

79 Ibid., p. 9-11.
strong level and had made changes to accommodate increasingly large numbers of students. Fernelius notes with regret that he was unable to "realize as good an organization and quality of teaching" at Penn State as he knew at Ohio State. This was perhaps related to a problem that he experienced at Ohio State. This problem involved obtaining broad cooperation by the faculty in the Freshman program. Professor Fernelius viewed this as one area of failure:

Looking back over the years of my association with general chemistry, I recall only one complete failure. This was the matter of getting wide participation of the entire faculty in the program. Dr. Evans felt that every staff member if at all possible should have one recitation section just so that more students had an opportunity for contact with faculty members. Hence he urged, cajoled, pushed and even forced cooperation. Many just didn't want to participate and the excuses given were almost ludicrous. Some refused outright; some entered in whole heartedly but the performance was less than satisfactory. The technique of getting class participation at the elementary level, of rating students without loss of class time, and of keeping the answers within the comprehension of elementary students requires talent and must be cultivated. From the point of view of the students and the smooth operation of the course, I would have preferred that there be enthusiastic participation or none at all. Fortunate indeed, is the department where a large fraction of the faculty want to participate in the elementary courses.

This difficulty was due in part to the higher degree of status associated with research and teaching solely one's own speciality.

---

80 Ibid., p. 19.
81 Ibid.
Many of the new generation of professors lacked the deep commitment to undergraduate teaching that was exemplified by Evans, McPherson and Henderson. The growing emphasis on research and the attaining of status in the discipline tended to decrease the overall faculty commitment to excellence in teaching freshman. To men like Evans, teaching freshman was a trust, and they were honored to be permitted to perform this service. Many of the new generation of faculty members viewed freshman teaching, and often teaching in general, as something to be avoided or at least minimized. The ideal of the university professor as a teacher-scholar had been undergoing a change. This change resulted in making it increasingly difficult to secure the broad faculty commitment to the freshman program that characterized the Department under Norton, McPherson, and Evans. The use of research and graduate education were becoming increasingly important and the emphasis changed from a primary concern for teaching to one of scholarship and research productivity.
CHAPTER VI

THE MACK, GARRETT ERA

A Change in Priorities

Immediately prior to the Depression the University was becoming increasingly concerned with the development of scholarship in its faculty. President Rightmire had initiated an effort to improve teaching at the elementary level in the mid-1920's, but his concern did not limit itself to that area alone. He pictured the spirit of the university as being much broader and different from that of the college.

Large projects are being carried forward here in various departments and the support for them is continued from year to year by the interested group outside, and it is quite certain that it is the presence and activity of members of a Faculty capable of doing high-class investigational work which strikes a proper university keynote. There must be excellent teaching, excellent ability to organize fields of knowledge for proper presentation to groups of students, and there must be personality and enthusiasm in the teaching group; but there must be indispensably by that additional something which is brought into the picture by the presence of Faculty members having the keen ability and vigorous investigational urge which stir live teachers, beckon them forward and upward, and inject the element which marks the difference between a college and a university. It has been well said that a true university teacher functions on three levels, namely, teaching in the elementary field, so as not to depart from a contact with youth in its initial university studies; counseling with upper classmen, to preserve the continuity of his experience with students, and to be able to give the wider range of thought and attention which the student
must be prepared to support in those high fields; and on the graduate level, where he may be entirely free to exercise his own organizing and synthesizing and research abilities, and to give the highest type of stimulus to the graduate students. In addition to all this the preferred type of university professor is interested in his peculiar research problems which grow out of his own experience and which give him the maximum opportunity for displaying his intellectual temper. Research must increasingly receive University attention and support; the University must welcome support for research from outside, and it must endeavor to give to the members of the Faculty who are especially gifted in this area appropriate time and means for carrying forward their study. These studies redound to the benefit not only of the research worker but to the University as an institution and make it a place more attractive to do faculty service in on all levels. Sympathetic, highly intelligent, and enthusiastic teaching by great personalities makes of the student body a hive, and a very definite result of higher studies and research activities carried on by members of the Faculty is a degree of buoyancy and stimulus which makes the University Faculty likewise an inspired scholastic community.\(^1\)

According to this ideal, the university faculty member was intimately involved in some way with his field of study in a productive fashion. In 1927 the Administrative Council formulated a statement\(^2\) on the basis for membership and promotion of the faculty. The lower ranks were considered proving grounds for the higher ranks. In evaluating faculty members for promotion scholarly productivity was considered important because it was felt that it would result in an increase in teaching effectiveness. The council stated:

---

\(^1\)Board of Trustees, Sixty-first Annual Report, 1930-31, p. 9.

\(^2\)University Faculty, 'Faculty Record, 1928-29,' p. 141.
Increasing attention, by the head of the department and the dean, should be given to the assistant professor's growth in scholarly qualities as indicated by his productivity, since this is an indication of the extent to which he will be intimately identified with his subject. Moreover, such productivity will react favorably upon his teaching effectiveness. An assistant professor who contributes to his field receives a personal reinforcement and confidence which he cannot possibly receive without finding himself intimately identified with the literature of his field. The obvious psychological effect of such reinforcement is reflected in teaching effectiveness. This, unfortunately, is not generally understood or believed. Current opinion has it that productivity and teaching competency are incompatible, mutually exclusive, or independent. There are those who even go so far as to divorce the investigator from the teacher.

It is doubtful whether the highest type of teaching can be secured from a person who devotes his entire time to teaching facts discovered by others. In these circumstances the teacher never feels himself an integral part of his subject. Such a person is likely to succumb to the mechanics and routine of instructor. Nothing will so effectively underwrite the death of a teacher in higher institutions of learning as relaying the facts of a subject with which he does not feel himself personally identified by reason of contribution, even though the amount of this contribution may be small.3

The definition of productive scholarship was broad:

This does not mean that he should be a prolific writer. It does not mean that he should necessarily do research in the factual field of his subject. It does mean, however, that he should make contributions on new methods of presentation, new organization of old instructional material, reorganization of the courses in terms of new facts in his field, study of objectives in the light of student interest, and the structure of curricula with reference thereto, et cetera.4

3Ibid., p. 143.
4Ibid.
The rank of full professor, to be significant, was to be given only to "acknowledge scholars" in their field, who were consistently advancing the outposts of the disciplines. The highest type of professional classes, however, was the research professor, "who may be so highly specialized as to make such a professor incompetent to do various and sundry committee work or even, in extreme cases, he may become so absorbed in research as to disqualify him for effective teaching, except in its most advanced form". "Such cases are, of course, relatively rare and represents the highest type of professional class - John Dewey and Edward Thorndike are representative of this rare class".5

This ideal of the faculty member was seen as presenting a problem to those departments which had large elementary courses and consequently needed a large number of teachers at this level. Two alternatives were seen. One was to have a staff of elementary teachers who did not pursue research and to offer them tenure and promotion. The other would be to hire a large number of inexperienced teachers who were pursuing graduate work and had promise of scholarly achievement, most of whom would leave after a relatively short period.

In those large departments where a considerable staff of teachers of elementary courses is required, the question has arisen as to the desirability of making this work as a university career. Should we hold out the promise of indefinite tenure and reasonable promotion

5Ibid., p. 144.
to the teacher of elementary courses who does not qualify as a scholar? The alternative is to recruit this section of our staff from younger and less experienced persons who are pursuing graduate studies and whose interests and qualifications promise high future attainment. This course necessarily involves a much larger annual replacement, as it is obviously possible to advance to the higher ranks only the very exceptional instructor and then only when there is a vacancy. The wise course would seem to be to follow generally the second policy, though not so exclusively as to deprive the University of at least a few seasoned teachers in the elementary area. It would be most unfortunate if the elementary work in these large departments were staffed wholly or chiefly by persons whose interests and competence did not go beyond that work. Even at the price of some inexperience and a relatively large overturn, it is better that our junior staff be composed chiefly of men and women with real scholarly interests, who have the promise of advancing, at this university or elsewhere, to the higher university ranks to which scholarship is a prerequisite.

So far as possible, it is, of course, desirable that members of the senior staff in the large departments keep in touch with the elementary work by occasionally teaching a section of an elementary course. This has a definitely tonic effect in bringing an experienced and scholarly teacher into comparison with his junior colleagues. It dignifies and emphasizes the great importance of work in this area, and it is always a valuable experience for the senior. Under present conditions, however, it is quite out of the question to expect members of the senior staff to undertake to teach more than an occasional section of an elementary course. Their time and energy is too fully absorbed in advanced work.

It was recognized that such "scholar-teachers" could only pursue scholarly activities if their teaching loads were lightened to as low as eight or even six hours.

---

7 Ibid., p. 102.
The Depression, however, stunted to a certain extent both the improvements in the lower division teaching and the move toward lower teaching loads. The conditions of the Depression, were, in fact, to raise the teaching loads.

As the Depression phased out the morale of the faculty reached a low ebb. There was a great deal of faculty dissatisfaction in a number of areas. On May 12, 1938 the University Faculty adopted a motion "that a committee be appointed by the President to study existing departmental procedures in the matter of departmental organization and control, including policy formation, selection of personnel, promotion and dismissal, curricular problems, and the like".

The Committee sent out questionnaires to faculty members and department chairman. Faculty opinion indicated the following area of concerns; in order of emphasis:

1. Physical non-laboratory facilities, office space, desks, files, etc.
2. Salary scale within the department.
3. Opportunity for research and writing in terms of time.
4. Adjustment in teaching load for research.
5. "Dry raises".
6. Opportunity for research and writing in terms of equipment.

---

8 The Ohio State University Faculty, "Special Faculty Committee on Departmental Organization, Procedures, and Control, Final Report", The Ohio State University Archives, 1940.
7. Promotion in rank.

8. Bases or standards for promotion.

9. Salary scale in relation to other departments.

Especially interesting is the reply of the department chairman as to their standards for promotion. Every chairman replying listed general scholarship as a factor, with the publications and research being cited most frequently as indicators of scholarship. Twenty-eighth listed teaching performance as a factor. Thus the faculty was concerned primarily with salaries, promotion, and the opportunity to do research and the department chairman used research productivity as their principle standard for promotion.

In addition, there was dissatisfaction with the pattern of administration in some departments. This occurred where the department chairman failed to consult with the faculty and bring them into the decision-making process.

As a result of the study the Committee recommended that department chairman pursue a consultative approach on matters of departmental policy, that chairman serve only for a limited tenure, and that a faculty council be established to involve the faculty more directly in the formation of university policy.

The policy of the institution and the departments began to reflect to a greater extent these attitudes of the faculty and there was a greater emphasis on decreasing impediments to research and scholarship, and basing salaries and promotion on evidence of productive scholarship.

\[9\text{Ibid.}, \ p.\ 6.\]

\[10\text{Ibid.}, \ p.\ 26.\]
On February 1, 1940 Howard L. Bevis assumed the Presidency of the Ohio State University. One of his first concerns was the problem of physical facilities. This was to be one of his major concerns. President Bevis did not supply the emphasis on the lower division teaching effort that had been done by President Rightmire. In great measure this was undoubtedly due to the poor physical facilities enjoyed by the University as a result of the depression, the needs of a nation at War, and the subsequent increase in student body.

Furthermore there was the increasing emphasis on graduate work and research. The Inter-University Council of Ohio had tabbed Ohio State as the center for graduate education and research. The Council resolved on November 20, 1941 thus:

1. The Ohio State University with its existing plant, facilities, and specially trained personnel is the logical institution among the five state universities for the development and prosecution of graduate work at the Ph.D. level; for specialized technological training; and for professional education such as Law, Medicine, Dentistry, Veterinary Medicine, Pharmacy, etc. Accordingly, the Ohio State University will place its developmental emphasis in these areas.

Dean Smith of the Graduate School expressed the belief that the Graduate School had slowly moved to the center of the University and that

12 Ibid., p. 13.
13 Board of Trustees, Seventy-First Annual Report, 1940-41, p. 35.
its standards and philosophies affected the instruction offered by colleges and secondary schools. He stated:

To an increasing degree professional schools demand graduate training for participation in teaching and research. Leadership in business and industry now requires more than an undergraduate preparation. The graduate school is attempting to maintain this central position in the University by fostering both teaching and research on a high level.14

In conjunction with this increased emphasis on graduate education and research funding was increasingly available to enable these programs to expand. In 1936 the Ohio State Research Foundation was established.15 Although the Research Foundation expanded only slowly at first, by 1941 it was making a substantial contribution to the Graduate School by funding a number of important projects and the hiring of eleven post-doctoral fellows and fifty-four research fellows. In addition the Development Fund provided funds for fellowships, books, and equipment.16 In 1940-41 it provided about $22,000. Federal funding was small but it was to increase with the advent of the war.17

In 1941-42 there was an increase in the state appropriation which enabled the University to make selective salary increases and additions to the faculty.18

14Ibid., p. 24.
16Board of Trustees, Seventy-First Annual Report, 1940-41, p. 27.
18Ibid., p. 43.
This made it possible to advance some of the younger men in the lower ranks and to strengthen the research program in some degree.

These developments tended to foster a situation in which the younger faculty members strove for excellence in research sometimes at the expense of interest in undergraduate teaching. The tendency was to move out of teaching at the elementary level as soon as possible in order to concentrate on research. A minimum teaching load became both desirable and a status symbol. The ideal was the research professor who avoided university related duties and teaching. At the forty-first meeting of the Association of American Universities held at the University of Missouri, the principle paper was presented by President Day of Cornell who critized faculties very severely for minimizing the importance of teaching. He stated that the older faculty members should take a greater responsibility in emphasizing the importance of teaching to the younger men in the faculty. 19

The increased emphasis on graduate and professional education and the tendency of the younger faculty members to concentrate on their area of specialized research and avoid the service courses led to certain undesirable tendencies in educational policy in the view of the Council on Instruction:

In the pursuit of its functions the Council on Instruction encounters many rather well-defined tendencies in educational policy some of which appear to be undesirable.

19University Faculty, "Faculty Record, 1939-40", p. 85.
Indicative of the types of undesirable tendencies are the following:

1. There is a persistent tendency in some areas on the campus to attempt year after year to expand course offerings. Expansion in itself may or may not be desirable. It is likely to be undesirable when it merely results in "thinning-out" an existing course or courses. Fragmentation of course content is costly, frequently does not permit of the optimum use of the teacher's time, and encourages extreme specialization on the part of the student.

2. There is a persistent tendency for some of our vocational curricula to become more and more restricted to narrow, specialized training. This trend involves the gradual elimination of requirements in the fields traditionally considered as basic foundations of sound education, and the further restricting of electives so that these become merely alternative choices among offerings in vocational training courses. This movement produces the strange anomaly of the required elective, and, apparently springs from a belief that if a student can be given enough courses in some specialized field he may be made so proficient in his chosen occupation that he will have no need for a well-rounded education.

As a consequence, so much of the student's time is monopolized by specialized study that a liberal education becomes an impossibility, and courses of broad human significance languish because students simply have no opportunity to elect them.

3. There is a persistent tendency on the part of some of the faculty to abet students who are seeking a degree rather than an education. Many students want college credit for everything they do, and do not seek knowledge for its own sake. By giving students hour credits for more and more activities, the chance to pursue which should be a privilege, the faculty trains students to expect a payment for doing what they presumably wish, or should wish, to do anyway.
4. There is a persistent tendency among certain departments to expand the scope of their instruction into subjects which traditionally belong in other areas. Doubtless this practice often arises from a commendable desire to supplement and integrate the special work of the department with that of allied areas. Nevertheless, it results in multiple attempts to reproduce the university within departmental confines, in endless duplication of effort, and in failure to utilize the collective resources of the University for integrated education. In the interests of both economy and the intellectual welfare of the student, the preferable procedure should be one of close cooperation among related departments.20

It has been mentioned earlier that in 1942-43 the Policy Committee of the Faculty Council felt it necessary to recommend that the service courses be differentiated from the specialized courses and that it be accorded recognition on an equal footing with other areas of endeavor.21 However the status associated with research, the requirements of promotion, the increasing availability of research money coupled with a more democratic, consultative approach to departmental administration resulted in a growing tendency of the faculty and the departments to push for lower teaching loads and to avoid teaching the large elementary courses. This emphasis on research and specialization and the status and rewards afforded concrete evidence of scholarship changed the nature of the institution and its faculty and this was reflected in the type of college teacher that was produced.

21 University Faculty Council, "Minutes," 1942-43, p. 263.
22 Ibid., p. 264.
There was a feeling among colleges of liberal arts that the college teachers who were being turned out by the graduate schools were too specialized and more interested in making contributions in the area of research to their discipline than in serving students and the institution. In 1944 the Graduate School sent letters to the presidents of 500 liberal arts colleges asking for constructive suggestions on the selection and preparation of college teachers. The following were reported as some of the more significant comments:

1. Graduate schools should have a plan for weeding out those not personally or intellectually adapted to the needs of the teaching profession.

2. There has been too much specialization and departmentalization in the training of college instructors.

3. A broad liberal education accompanied by thorough scholarship in a chosen field is necessary for good college teaching.

4. Graduate schools should provide for a period of internship or apprenticeship for prospective college teachers.

5. College instructors should be interested in rendering services to the students and to the college rather than in advancing their own narrow professional interests.

6. Graduate schools frequently put too much emphasis on research and frown on teaching as a profession.

7. Two kinds of Ph.D. degrees— one for research workers and one for teachers — would be helpful.

8. More emphasis should be placed on personal characteristics of prospective instructors and on their ideals and responsibilities as citizens.23

The four year colleges evidently did not share the view of the University that first class teaching could take place only in conjunction with an emphasis on research productivity, but rather felt that in the real situation that developed the emphasis on research productivity and specialization did in fact detract from undergraduate teaching.

The Dean of the Graduate School in reporting these comments expressed the hope "that each department will review carefully its graduate program for the preparation of college teachers to the end that it may more fully meet the needs of colleges of liberal arts and sciences". 24

However, it was to be expected that the Institutions which supplied the teachers and researchers to both colleges and universities tended to turn out people who reflected the milieu in which they were trained and that milieu was one in which increasingly research and orientation to the discipline were afforded high status and teaching, especially at the elementary level, along with institutional orientation were afforded a low status. For graduate students a research assistantship tended to become more desirable than a teaching assistantship because the teaching assistantship required time which could be spent in the more useful area of research. After a graduate student would enter with a teaching assistantship he could, with sufficient effort, improve his lot to that of a research assistantship. This phenomena was accentuated with increasing money available for research assistant-

24 Ibid.
ships. It was no longer as important to do a good job teaching and often the faculty did not provide the example or leadership which emphasized good teaching. Yet this sort of specialized training which afforded low status to elementary teaching was the training that was given to those people who would ultimately be employed as college and university teachers. Thus the situation developed so that the teaching aspect of the teacher-scholar ideal began to be downgraded and any teaching that was done was preferably in one's own speciality. Relatively few faculty members would achieve the distinction of excellence both as a top flight specialist and a great liberal teacher. Many could not bridge the gap between their specialized education and the broad requirements of scholarship and personality needed to teach at the elementary level; most were prisoners of their training who sought to avoid teaching at this level.

The war was to accelerate the tendency toward the feeling that the central mission of the university was research and graduate education. The war saw a great upsurge in government contracts for research and many individuals devoted the major portion of their strength and industry during the war in serving their country on war related research.25

In the first six years of its existence the Research Foundation experienced almost geometric growth. In 1942-43 it reported that on September 30, 1942, it was scheduled to receive funds at the rate of $1,907,792 per year. During the prior year, 1941-42 it had received a

total of $314,945.81 and this amount was almost two and one-half times as large as that received during 1940-41. On June 1, 1943 fifty projects were active with an annual budget totaling $2,496,262. In 1942-43 the foundation reported that the money expendable under its contracts was up sixty-five per cent in the case of industrial contracts and over four hundred per cent in the case of governmental contracts. This necessitated a three fold increase in its office staff during the year.

The lack of status associated with the teaching of elementary courses together with the greater emphasis on research and availability of money fostered by the war accelerated the trend among the permanent faculty to give only minimal attention to the teaching of these courses.

After the war there was a great upsurge in enrollment due to the returning veterans. On V. J. Day there were 4,732 students on campus; in seven months, Spring, 1946, this number had risen to 16,148. In Autumn Quarter, 1946, 9,444 new students were admitted to the university. By Autumn of 1964-47 the enrollment had reached 24,867. Initially this put a great strain on the freshman instruction. The demand for instruction at the elementary level was met in large

26 Ibid.
27 Board of Trustees, Seventy-Third Annual Report, 1942-43, p. 36.
28 Board of Trustees, Seventy-Sixth Annual Report, 1945-46, p. 61.
29 Board of Trustees, Seventy-Seventh Annual Report, 1946-47, p. 12.
part by the employment of large numbers of graduate students, public school teachers, and others on temporary contracts. This was made possible in part by the large increase in graduate student enrollment which provided a ready source of inexpensive instructors along with the use of mass classes.

At the same time the university found that it was facing increasing competition in recruiting new permanent faculty and holding onto its present faculty because other universities were searching for scholars and now there was the added competition from governmental agencies and industry. The contributions made by the university scholars during the war awakened a greater recognition of the importance of research.

The need for faculty to teach undergraduate courses and the needs in the area of graduate education and research were in serious competition. These concerns were voiced by the Programs Committee of the Faculty Council in its report of 1946-47. Some of the problems suggested for study included:

1. What additional steps, if any, should the university take to meet the enrollment problem? For example, should enrollment be limited? Should branches of the university be established in other communities of the state for some of the work of the first and second year?

31 Board of Trustees, Seventy-Seventh Annual Report, 1946-47, p. 25.
32 Board of Trustees, Seventy-Sixth Annual Report, 1945-46, p. 16.
33 Ibid., p. 17.
34 Board of Trustees, Seventy-Seventh Annual Report, 1946-47, p. 16.
2. What program, if any, should the faculty undertake for (1) improving the quality of teaching and (2) stimulating its scholarly productivity?

3. Should a University College, for the first year, or two years, of the undergraduate program be established? If so, under what conditions?

The faculty seemed to share the opinion that large enrollment in the lower years was detrimental to the purpose of the institution, and that emphasis in the future should be in the graduate and professional areas, with the lower division years being handled to an increasing extent by other types of institutions. President Bevis held that many of the faculty members held the opinion that emphasis should be made in the graduate and professional areas and this opinion was transmitted to the Board of Trustees when it was favorably received. Bevis expressed the opinion that much of the work in some fields can be done elsewhere in the state. "We might, therefore, encourage our neighbors to carry a greater share of the teaching they can do well. The graduate, research, and professional work, which is carried at a higher cost and for fewer students, could be done here. It is not thought that all of the elementary work would be abandoned on the campus, but that the emphasis would be of the higher level."

36 Ibid., p. 6-7.
In September, 1946 at the meeting of the Board of Trustees, long range plans for the University were considered. The starting point was a report prepared by the University administration, deans, and department chairman. This report represented a great deal of the University thinking on a variety of problems and activities. Part one of this report concerned "The Mission of the University" and is revealing in documenting the changing emphasis in the University community.

The Mission of the University

This attempt to plan the next steps in the life of our University is rooted in the conviction that satisfactory life in America is vitally and increasingly dependent upon the continual development of American higher education. Satisfactory life in the American sense implies production adequate to the people's wants, economic and political organization adequate to the maintenance of complex modern life, and cultural ideals infused by spiritual aspirations within the reach of more and more of the people. This burden rests peculiarly upon American higher education because war and totalitarian philosophy have gravely impaired the capacities of old-world schools. . .

This period of living on Nature's bounty is visibly approaching the end. . . Basic research for useful knowledge never yet acquired and the dissemination of that knowledge among those who can apply it are indispensable to the civilization of the world. Basic research and the wide dissemination of knowledge are peculiarly the function of modern higher education. Without its services we must have lost the war. Without them life in peace, if such peace be possible, must degenerate into a straitened regime of gradually diminished standards until the grim law of biologic balance has its way.
In science and the dissemination of knowledge, lie the only hope of adequate sustenance and supply. But, it is a hope of unexampled brilliancy. Standards of physical living, never before glimpsed in human history, lie within our reach. Higher education is essential to their realization.

Beyond knowledge and reason, beyond the thrills and transports of emotion, there is faith, that indefinable faculty which fastens upon objectives dimly sensed and unlocks capacities otherwise unrealized. Education which ignores faith must progress to ultimate sterility.

In the list of state supported universities, Ohio State ranks high. As the chief university of a diversified state, the catalog of its offerings is broad and varied. With few exceptions the service of its departments is adequate. Several of its colleges compete for top honors in the nation. By state university standards its faculty members are well compensated. Only in the "key men" brackets is it still at some disadvantage among its competitors.

Its function is three-fold: Teaching, Research and Service.

Alone among the State Universities of Ohio, it carries on work at the doctoral level. Except in education, no other State University in Ohio provides professional training. For a time by statute, and now by voluntary agreement, it is the only State University in Ohio offering doctoral and professional degrees.

In planning for the future of Ohio State, this question of major importance immediately presents itself: Shall we seek to expand our undergraduate numbers to the limit of our competitive ability or shall we increasingly place our emphasis on graduate and professional work in which research and service shall stand upon their own feet, budgetarily and otherwise?
We may assume, at this stage, that research is essential to greatness or even respectability in any university. We may assume, too, that an undergraduate base is desirable in a complete university structure. The question is one of emphasis...

It would seem the part of wisdom, therefore, to re-emphasize the policy established by the State Legislature in 1904 and confirmed by the Inter-University Council in 1941, namely, to make of Ohio State preeminently the center of research, graduate and professional work and to share with our sister institutions the giving of undergraduate instruction...

Ohio State, like other state universities, began as a teaching institution. More recently, we have realized that first class teaching is possible only in conjunction with the search for new knowledge, and much research of high importance has been done here. But, we have only begun to emerge from the institutional philosophy that research is an incident of teaching to be accomplished in spare time by those paid for the primary business of instruction. It is time that we make the overt decision to establish genuine research as a prime and coordinate objective of University policy. Until this decision is made and implemented we shall not attain our full university stature...37

The Program Committee "moved that the President of the University appoint a committee of five members from the University Faculty to study the advisability of the University (1) placing greater emphasis on graduate and professional work and (2) de-emphasizing or decentralizing undergraduate instruction, and that if the committee favors much change in emphasis, it be directed to recommend to the faculty council a program for implementing the change."38

38Ibid., p. 18.
This resolution was adopted without difficulty by the Faculty Council; however, they did feel it advisable to modify the resolution by changing the words underlined to read "to study the effect of the large enrollments on the primary functions and principle objectives of the University."^39

Interestingly another resolution had difficulty passing. The resolution was:

Moved that the President of the University be requested to appoint a committee of five members from the University Faculty to study ways and means of improving the teaching competence of the Faculty, and that the committee be directed to report its findings and recommendations to the Faculty Council.^40

The chair took a voice vote on the resolution and the issue was in doubt. A division showed twenty voting "Aye" and thirteen voting "Nay."^41

The following year the Committee on Emphasis on Graduate and Professional Instruction and Research made its report which was approved without modification by the Faculty Council. The committee did not question that the emphasis in the future should be primarily on graduate instruction and research, but concerned itself with the implementation of this goal.

^39 Ibid., p. 21.
^40 Ibid., p. 20.
^41 Ibid., p. 21.
The Committee stated:

At their meeting on Gibraltar Island in September 1946, the President and the Board of Trustees formulated the policy that The Ohio State University is to emphasize graduate and professional work and research. This momentous decision was strategically timed in recognition of current educational trends and of the contributions this University can make in advanced education and research in the State and Nation. By their action, the President and Board of Trustees have placed a milestone at the appropriate point in the history of the University.

The real issues before us are to what degree is the milestone to be recognized as indicating the direction of progress, and how the course marked out for the University is to be implemented.

The facts that increasing numbers of students are presenting themselves for advanced studies, and that the faculty is eager to push forward in specialized education and research are indications of the magnitude of our challenge and of the faculty's awareness of it. The large enrollment of advanced students and the wide variety of educational and research activities complicate implementation of the policy. Careful consideration of our problems and determination of a plan of action are necessary to make the milestone of policy an index of accomplishment and not merely a verbal marker.

Solution of the problems that confront us in connection with the implementation of the declared policy centers around five main requirements: (1) of an appreciation of our potentialities; (2) sufficient numbers of qualified faculty personnel; (3) adequate physical and financial resources; (4) selective limitation of students; and (5) appropriate modifications in our administrative philosophy and machinery.42

The committee further stated concerning the requirements of attaining an appreciation of the potentialities of the University in the area of research and graduate instruction that it was "particularly encouraged by the acceptance of the problems associated with increased enrollments, without the attention to such problems interfering seriously with genuine advances in the University". They stressed the importance of a recruiting "a superior faculty adequate in quality and numbers to carry on our advanced teaching and research activities".\textsuperscript{43}

The committee recommended that teaching loads be re-evaluated in light of the changing emphasis at the University. In 1948 a faculty committee recommended the following teaching loads: (Average maximum)\textsuperscript{44}

- Professors: 9 hrs.
- Assoc. Professors: 10 hrs.
- Assist. Professors: 11 hrs.
- Instructors: 12 hrs.

The enrollment situation did, however, limit what could be done in this area until the enrollment eased up. In 1948-49 there was an easing of enrollment pressure and the University was able to consolidate gains in faculty strength. The university turned\textsuperscript{45} more and more to the development of the type of permanent and professional staff required by its

\textsuperscript{43}Ibid., p. 31.

\textsuperscript{44}University Faculty Council, "Minutes, 1948-49", p. 30-32.

\textsuperscript{45}Board of Trustees, Seventy-Ninth Annual Report, 1948-49, p. 13.
announced plan to seek pre-eminence in advanced studies and research. 46

Fortunately money to support an increasing research program was available. Industrially sponsored research projects had enjoyed a steady growth since the establishment of the Research Foundation. Government-sponsored projects, which began about 1939 on a small scale, had expanded rapidly during the war because of the national crisis. The contribution made by universities in this area were given more formal recognition after the war. Although immediately after the war government research fell to about half that during the peak of the war, by 1948 it had grown rapidly that it considerably surpassed the war-time peak. In 1948-49 the Research Foundation 47 reported 134 projects involving forty industrial companies and fifteen government agencies in operation in twenty-five departments involving 106 faculty members and 596 individuals. 48

The movement of the faculty into the higher levels of teaching and research to a greater extent than previously was the case tended to leave the elementary teaching to less experienced faculty members and junior staff members. This together with the large numbers of students of various aptitudes involved in these courses resulted in a committee being appointed by President Bevis on February 8, 1949 to examine and report on the topics of: 49

46 Ibid., p. 28-29.
47 Ibid., p. 66.
48 Ibid., p. 65.
1. Improvement of teaching
2. Teacher-training for the Junior Staff
3. Remedial Work for the Poor Student
4. Special attention to the superior student

The committee reported that improvement of teaching was dependent upon allowing the faculty member to be free to develop his own abilities. It opposed the imposition of standards by others. The committee stated:

**Improvement of Teaching**

Good teaching comes about through the development of natural talents, training in methods accessory to the central element of ability, emulation of skilled teachers, and self-instruction through experience. Freedom of development in contrast to imposed standards is the essential of teaching as other arts. While self-discipline is an imperative element in improvement in the art of teaching, other faculty members who have developed their skills and methods should serve as examples of successful teachers. They may guide and suggest improvements, but should use restraint and mutual respect in contacts with the developing teacher.

In this process of emulation and individual growth and self-discipline, certain principles may be followed that provide bases for improvement of teaching in the University. They are --

a) genuine creativeness in the classroom, seminar, library and laboratory;

b) organization of ideas;

c) communication of the meanings of a subject through vitalization, visualization when appropriate and utilization of genuine source materials;
d) generalization from specific subject-matter to larger issues in the same and related fields, its position in time and place, and its bearing on social and cultural issues; and

e) realization of the quality of human sympathy in students, in one's self as a teacher, and in the University as a social institution in a larger social setting.

These principles are applicable not in rigid order or mutually exclusively. The variability of emphasis depends in part on the nature of the subject but more on the individuality of the teacher and the stage of his development and perspective. The principles of effective teaching are all so basic that their recognition and observance are essential to the successful educational program of a University department. Thought should therefore be constantly given by the departmental teaching staff to the pursuit of these principles, balancing the individual capacities of its teachers so that the department presents a whole to its students, to the advancement of knowledge, and to society.

The good teacher, the investigator, and the organizer thus find their respective places and perform the functions for which they are best fitted, in addition to their participation in the primary function of a department, namely, teaching. The department and hence the University therefore constitute a unit in respect to creative teaching, transmission of subject content, general education, and research. Individual capacities have an opportunity to develop and freedom in education is maintained.50

On the subject of teacher training for the junior staff the committee felt that "too often this teaching resource is considered as 'cheap labor'". It recommended the following policies and practices:

a) active interest in good teaching in the department as a whole and by faculty members supervising teaching by the junior staff;

b) the encouragement and development in the young assistant of his particular capacities;

c) the opportunity to observe examples of good teaching and the provision of guidance by good teachers, both of these through visitation of classes;

d) training in the use of teaching aids;

e) proper balance and appropriate provisions for the dual role of graduate students as teachers and students;

f) progression in responsibility and type of instruction assigned to members of the junior staff, for the benefit of their knowledge, experience and stimulation;

g) inclusion of the junior staff in departmental meetings, at least when educational matters are discussed;

h) development in each department of formal or informal instruction in methods of teaching, broadly and in detail, as pertinent to that department and subject; and

i) encouragement of study by the junior staff of the basic psychological and philosophical principles involved in education, either in formal courses in the University or through close association with departmental faculty members having a broad outlook on education and its place in society.\(^1\)

\(^{51}\)Ibid., p. 243.
The committee also felt that the "policy of departmental responsibility includes a presentation to the junior staff of the department's equal regard for good teaching, research, historical perspective, and social relations". What the committee did not explain was how the junior staff was to have an equally high regard for teaching, at least at the elementary level, when the policy of the University and its faculty was to emphasize research and this emphasis was brought home by the actions of the faculty concerning their priorities.

Furthermore the encouragement of superior teaching by example and freedom of expression are all well and good where the example is positive and when the motivating influences encourage good teaching. However, to a greater and greater extent external influences on behavior, such as status, money, peer group acceptance and others tend to minimize the importance of undergraduate teaching.

The Chemistry Department After the Depression

The war had a profound effect on the Chemistry Department. The Department became deeply involved in government research projects. The Nature of the work was secret. President Bevis stated:

One of the first subjects that comes to mind when mentioning research for war purposes is that of Chemistry, and it is true that a considerable number of projects in this field are in progress

---

52 Board of Trustees, Seventy-Second Annual Report, 1941-42, p. 16.
on the Campus. Most of them are so secret, however, that the subjects of the investigation and their locations cannot be revealed.\footnote{53}

Professors Edward Mack, Jr. and Wallace R. Brode, Associate Professor Preston M. Harris, and Assistant Professors Edwin N. Lassettre and George E. MacWood were all on leave during the war carrying on work of a secret nature.\footnote{54}

The first research project of a military significance was given to Professor Wolfrom in October, 1940. Professor Johnston did low temperature research on hydrogen and Professor Brode carried on a high priority program of research on hydrocarbons. The significant nature of the research projects is seen in the fact that, despite severe war-time restrictions on new building, a new four story laboratory building, designated the War Research Building, was built in 1943 to provide space for these activities.\footnote{55}

The research activities of the Department during the war were not limited to government sponsored projects. In 1942-43 there were 44 industrially sponsored research projects in operation at the University. The Chemistry Department operated 11 of these projects, the largest number of any unit of the University. At the same time the\footnote{56} staff of the Department was able to find time to produce 38 papers of fundamental

\footnote{54}{Board of Trustees, \textit{Seventy-Fifth Annual Report, 1944-45}, p. 8.}

\footnote{55}{Caley, "History of The Chemistry Department", p. 15.}

\footnote{56}{Board of Trustees, \textit{Seventy-Fifth Annual Report, 1944-45}, p. 8.}
research under the severe handicap of depleted numbers and a scarcity of graduate students. Early in the war there was a change in leadership in the Department. In 1941 Edward Mack, Jr., who had returned to Columbus in 1939 to head the chemistry division at Battelle Memorial Institute, replaced William L. Evans as the chairman of the Chemistry Department. Professor Mack was considerably different in his administrative methods than the dogmatic Evans and this was more in keeping with the consultative form of departmental administration which had been recommended by the Faculty in 1941. This had come about because of considerable dissatisfaction in some departments with the administrative methods of their chairman. The recommendation of the use of consultation in the decision-making process was an attempt to meet this dissatisfaction. At the same time the selection procedure for departmental chairman was changed to include a greater faculty voice in the selection process and the tenure of the chairman was limited to four years. In this way a chairman would be more likely to reflect the views of the senior staff of his department. Edward Mack was more inclined to allow faculty members freedom in making decisions and treated them as professionals. Professor Evans had exerted strong and often rather autocratic leadership. During Professor Evans chairmanship

57 Board of Trustees, Seventy-Fifth Annual Report, 1944-45, p. 8.
58 Caley, "History of the Chemistry Department," p. 11.
59 University Faculty Council, "Minutes, 1941-42," p. 100.
60 Ibid., p. 305.
the Department was in part a reflection of his character and ideas. With the retirement of Professor Evans the Department would take on more of the character of the faculty as a whole.

These things would effect the General Chemistry program. Professor Evans, as we have seen, virtually forced many faculty members to participate in some way in the General Chemistry Program often in the face of opposition and excuses on the part of the faculty member. Professor Mack often allowed faculty members to teach only their own speciality to the exclusion of the teaching of the service courses.

The press of war research also caused a further separation of the senior staff from the freshman chemistry student. Traditionally senior staff members had been involved in teaching at least some of the recitations in the freshman courses. This practice was eliminated during the war and never revived.

In 1941, the system of fee collection for the general chemistry courses was charged and this decreased the flexibility of the Division. Prior to 1941 the laboratory fees were directly available to the General Chemistry Division. Professor Fernelius describes the system as follows:

The operation of the freshman chemistry stockroom and the employment of additional (but very necessary) typists and clerks in the general chemistry office was possible because of the method of collecting fees. There was a fee for each laboratory (and some other) courses. With this fee the student paid not only for the items he broke

---

61Fernelius, letter, p. 19.
but also his portion of a general account which included chemicals consumed, items given to each student, total cost of operating the stockroom, and extra help in the General Chemistry office. Each year some charges were made against this general account for capital equipment for lecture demonstration or for use in laboratory instruction. If some items such as a small spectrometer found use elsewhere when not needed for the freshman courses, no one objected but instruction always had first call. There was a small library in the freshman office of books often consulted by the junior staff including those on construction of examinations, evaluation of examination questions, etc. Other areas of the Department envied this flexibility of the General Chemistry Division and occasionally sought to persuade the Division it needed an item which some one in another division wanted for his use. In 1941 the system was changed so that there was a flow from all fees directly into the Department.

Thus the freshman area lost its flexibility (and, I suspect, also a good deal of the money it had formerly enjoyed). 62

The expansion of research in the department also affected the relationship of the graduate students to the freshman teaching program because it led to a situation which provided an option to teaching as a method for support while attending school. That option was the large increase in research fellowships and assistantships. In 1938-39 the Chemistry Department had three industrial fellowships and two university fellowships. In 1939-40 this situation changed dramatically with a total of seven industrial and two university fellowships. In 1940-41 the position of research assistant was established. Initially 5 were appointed but this number expanded rapidly. By 1969 the junior research staff outnumbered the junior teaching staff by 186 to 104. Often the

research assistantship was viewed as being more desirable. It afforded the opportunity to be paid for doing work which was often in the student's area of interest and could be used as the basis for his dissertation or thesis. A higher status became attached to methods of support which did not involve teaching. Often the best entering graduate students were offered fellowships and the other students were often given research appointments only after a couple of years teaching. The faculty viewed it as desirable to have their students working full-time on research rather than devoting part of their time to teaching. The opinion of the faculty concerning teaching at the elementary level filtered down to the graduate students and even among those graduate students who were teaching assistants there was a higher status in teaching in one of the specialized divisions. This provided a situation which could lead to problems for the administrator of the General Chemistry Division. In addition to the problems of getting the members of the senior staff to effectively contribute more than a minimum of effort to the Division, the junior teaching staff had little incentive, other than personal satisfaction, for doing a good teaching job. The attaining of a more desirable situation was not tied to success as a teacher but as a scholar and on the basis of research potential.

As time passed the junior staff was more and more relied upon to cope with the increasing enrollments in the lower division courses. After the war, the influx of veterans created a crisis in teaching, especially at the elementary level. During the peak quarter in 1946 about 4300 students were enrolled in general chemistry. These numbers gradually diminished, but remained above the pre-war levels. Today the enrollment in general chemistry has reached 3800 during peak quarters. The demand for teaching staff after the war was met primarily by expansion of the junior staff which exceeded 150 immediately after the war.

During the war only three people were appointed to the senior staff, Joseph F. Haskins, Margaret H. Kurbatov, and Helen O. Herren. Professor Haskins devoted the majority of his time to the teaching of the elementary courses until his retirement. After the war the University began to face serious competition for its scholars and teachers from educational institutions, government agencies, and industrial research laboratories. The loss of a number of scholars made it clear that the University would have to compensate its men at a higher level in order to keep them.

---

64 Board of Trustees, Seventy-Sixth Annual Report, 1945-46, p. 15.
65 Caley, "History of the Chemistry Department", p. 15.
66 Ibid., p. 40.
68 Board of Trustees, Seventy-Sixth Annual Report, 1945-46, p. 17.
This competition and the increasing support of research by both industry and government would make it possible for the faculty to gain higher salaries, greater independence, and lower teaching loads. This became especially the case in science and engineering departments because of national priorities in these areas.

Professor Mack, upon returning to the University from the Manhattan Project, was able to retain all of his senior staff and a number of new appointments were made between 1946 and 1950. These new appointments included:

1946  Earle R. Caley
      Louis Gordon
      Harold Shechter
      Thor Rubin
      Harry H. Sisler

1948  Donald O. Hofmann
      Quentin Van Winkle
      James I. Watters
      Christopher L. Wilson

1949  Earl W. Malmberg
      Thomas R. Sweet

1950  Jack G. Calvert
      William J. Taylor

---

Ibid., p. 17.
However, because of replacement of losses from the staff, the number of senior staff members increased only from 21 in 1940 to 26 in 1950. Between 1951 and 1960 inclusive 10 men were appointed to the staff and from 1961 to 1965 a total of 17 new appointments were made.\(^70\) Between 1965 and 1971 14 new men were appointed. Resignations, retirements, and deaths resulted in a net increase of about 20 senior staff members from 1950 to 1970. The bulk of this expansion was due to the expanding support of research in the country and the availability of money for the support of these activities. Although many of the people added to the staff during this period would lecture general chemistry, this usually occurred early in their careers and relatively few became significantly involved in the program beyond their lecturing responsibilities. This was probably due to the press for research productivity as a demonstratable measure of scholarship, the lack of status associated with the teaching freshman chemistry, and a genuine preference for research in their special area of training. Only 6 or 7 of the 31 new appointments involved people who make serious contributions in the area of freshman education.

During the period from 1942, until he took over the chairmanship of the Department, Alfred B. Garrett was in charge of the Division of

of General Chemistry. Professor Garrett was not only interested in the
teaching of proficiency students and the program at Ohio State but was
active nationally in chemical education. He was involved with both the
"Chemical Bond Approach" and "Chem Study" projects of the National
Science Foundation, the Division of Chemical Education of the American
Chemical Society and the visiting scientist program, he continued the
tradition of writing by authoring and co-authoring a number of books and
contributing to the literature of chemical education, and many other
projects.

Professor Garrett recalls\(^7\) that the movement to improve the
scholarly character of the faculty was partially a reaction against
some faculty members who simply taught their courses and did not
contribute a full days work to the University. The feeling was that
the University needed good teachers who were also productive scholars.
Over the years however, he saw an imbalance developing which resulted in
an emphasis on the scholarly research activities of the professor and a
loss in the sense of importance of teaching, especially teaching at the
freshman level. He attributes this to a number of causes. One was the
tendency to competition among institutions aggravated by a system of
rating by the American Council on Education; a system Garrett feels
was weighted heavily in favor of research productivity and quality.

\(^7\) A. B. Garrett, private interviews held during December, 1972
and February, 1973 at The Ohio State University, Columbus, Ohio.
This contributed to the establishment of these factors as the paramount measure for promotion and status among the faculty. This was abetted by the increased financial support for these activities from governmental and industrial sources.\textsuperscript{72} The most important factor in the mind of Professor Garrett was the lack of leadership that the department chairman and dean often exhibited in the area of faculty selection and promotion. Garrett believes that a university professor should be a good teacher who can do productive research, although there should be room for both the master teacher who does no research and the master research who does little teaching. The best situation arises when the professor does both. He feels, however, that very often the need for good teaching was not given sufficient weight and people were hired and given tenure who were poor teachers and researchers because of inadequate leadership and concern on the part of administrators. He points to a practice in some departments where the chairman would relegate those who were not competent or productive as scholars to teach in the freshman program and usually these were the worst teachers. The dean would "often let these situations ride."\textsuperscript{73}

Although the level of teaching in the Chemistry Department remained at a high level under Professor Garrett's leadership because of the contributions of a number of outstanding teachers to the program,


\textsuperscript{73}Garrett, private interview.
he did experience some of the problems caused by the declining status of freshman education and rise of the research orientation. He feels that Professor Mack, who was the chairman, although a good teacher himself, tended to soft-pedal the importance of teaching and failed to exert the leadership necessary to encourage the faculty to engage in creative teaching. The result was that the freshman program had to cope with an increasing lack of interest and indifference on the part of some faculty members. This was also a problem faced earlier by Fernelius, however Evans countered this indifference by strong leadership in promoting the cause of freshman education. Furthermore high status became associated with low teaching loads. Garrett reports that the attitude of some faculty members was such that they expressed envy of professor who "were lucky because they didn't have to teach". He reports that this attitude also extended into the area of graduate education where the emphasis began to change from teaching to one of production. Even in the area of post-doctoral program, originally designed to allow post-doctoral students to pursue their interests under the direction of a more experienced professor, Garrett saw a trend toward using post-doctoral students primarily as "a more sophisticated set of hands" in order to turn out more papers for the professor.  

The professor tended to move out of the laboratory and become directors of research projects committed to producing

---

74 Garrett, private interview.
publications and with the teaching-learning aspect secondary. Garrett found that many of the new assistant professors were concerned about getting a post-doctoral student as soon as possible to work on the professor's projects.

Garrett reports that this indifference toward teaching often led to a lack of preparation by the professor who lectured in the freshman program. The supervision of the teaching assistants was an area where problems developed. When the senior staff was relieved of their assignments to teach recitation classes during the war, it was with the understanding that they would closely supervise the teaching assistants by visiting recitations and laboratories and giving suggestions and help to the assistants. This often did not occur. The senior staff often set a bad example for the junior staff, which was inexperienced and in need of close supervision. In 1958, Professor Garrett initiated a program by which the teaching assistants were given a week long orientation program on teaching. The primary purpose was to prepare them for their teaching responsibilities, to expose them to some good and enthusiastic teachers, and to impress upon them the importance of their assignment. At the end of the week they were given a series of examinations to determine their proficiency in various areas of chemistry. Over the years the program has devoted an increasing fraction of its time to orientating the new graduate students to the graduate program. There continued to be problems of motivating the teaching assistants in the face of faculty indifference to the program. In the mid-1960's
a summer program was developed by which a number of teaching assistants were given a summer long course for credit on lecturing methods and techniques. This program was successful, but lack of funding led to its curtailment. Eventually the head of the Division of General Chemistry felt compelled to hire staff members to coordinate and innovate in the laboratory program and to supervise the junior staff in terms of visiting recitations and giving advice to the instructors.

Professor Garrett also experienced a reluctance on the part of the faculty to prepare properly and far enough ahead to give demonstrations in lectures. He felt that this was an important technique to use in teaching introductory chemistry. There was a full-time lecture demonstrator available in the department and an extensive number of demonstrations which could be given. These demonstrations were listed along with their possible uses. But often the faculty was so lax in foresight or unimaginative in their teaching that few made use of these facilities. Related to this, he saw a lack of effort to understand the students and a tendency to "rub their noses into the ground," along with a rather casual approach to teaching. Garrett even found this in the honors program where some of the faculty was not judicious in the selection of content and often expected too much. He attributes this to a lack of understanding of the importance of social adjustment and a narrowness of vision due in part to the specialized background of the faculty member and, in some cases, the lack of
basic enjoyment of people, which he feels is necessary for effective teaching. Professor Garrett found it difficult to convince the faculty that an understanding of educational principles and a broader vision was useful for effective teaching at the freshman level. While a detailed examination of the general chemistry program beyond 1960 will be left to a later time when sufficient time has past to put it in proper perspective a few trends should be noted. The increased research commitment, together with the competition for scholars among universities led to a gradual reduction in the teaching loads of the senior staff. Although the expansion of the senior staff was quite substantial after 1950 there was a gradual trend toward the hiring of temporary staff to teach the lectures in the General Division. By 1972-73 this temporary staff was teaching a substantial share of the general chemistry courses, often quite effectively. Innovation and the day-to-day supervision of the general chemistry program was left primarily to the head of the General Chemistry Division and this temporary staff. It seems that as the introductory teaching became an increasingly minor concern of the faculty as a whole, the Division itself became more complex as it moved into areas of concern vacated by the faculty. While much of the burden of instruction was removed from the faculty by the Division it remained under the control of that faculty whose concern was to an increasing extent primarily in the area of research and graduate education.

75 This problem was also considered by McPherson in "Chemistry and Education," Science.

76 The records of the General Chemistry Division indicates that almost half of the lecture sections were handled by temporary staff.
CHAPTER VII

SUMMARY

The Methods Used in the Introductory Courses

Sidney Norton's teaching depended upon lecture, recitation, and demonstration in the introductory courses. He felt that it was necessary for the student to gain a mastery of the principles of chemistry before he could adequately make use of the laboratory experience. Norton stuck to this philosophy despite a growing acceptance over the years of the idea that the principles of a science such as chemistry could best be presented using the laboratory method. Ultimately this philosophical position of Norton led to his downfall and replacement by William McPherson as chairman of the department. McPherson introduced laboratory as an integral part of the introductory chemistry course and since that time the basic methods of lecture, laboratory, and recitation have always been part of these courses. McPherson also felt that the institution and faculty should provide the means to lead the student to self-education while Norton had relied on a great deal of personal contact and direction in his teaching method. McPherson's position suited the needs of an institution which was expanding and taking on new goals. The enrollment in the introductory courses was
becoming large and the kind of personal instruction that Norton provided required a great deal of time and a low student-faculty ratio. The University was also expanding into graduate and professional education, the disciplines were becoming more specialized, and many new courses developed. A philosophy of education which relied to a greater extent on the student and less on the time of the faculty member was consistent with the needs of the faculty and the institution. Thus the method which is still used today involving large lecture sections with smaller recitation and laboratory sections taught by graduate assistants developed. The rise of graduate education provided the basis for inexpensive instruction since graduate students could be hired to teach the laboratory classes and eventually the recitation classes. The need for inexpensive instruction and the desire to expand into graduate education tended to compliment each other.

Over the years there have been modifications of the basic lecture-laboratory-recitation method, but these have been more in the form of additions rather than new methods. Evans tried team-teaching with little success. Various devices have been introduced over the years to expand the means available for the students to educate themselves. But these have not altered the basic method used and in large measure reflect either the teaching philosophy of McPherson of providing the means by which the students can educate
themselves or the need for efficiency in instruction. Many of the recent developments such as the use of television in the laboratory, the development of computer assisted instruction, and the use of student assistants in laboratory have reflected these concerns.

The Organization of the Introductory Courses

A number of factors have affected the organization of the introductory courses over the years. In the early years there was just one course at the introductory level which was taken by all students regardless of their ability or their educational objectives. However as the years past a number of factors led to subdivisions of the introductory courses. These factors can be identified as follows:

(1) the scheduling requirement of the various colleges.
(2) the large number of students enrolled in the introductory courses.
(3) the requirements and objectives of various curricula.
(4) the background and preparation of the students.

In 1893 when the University organized itself into six distinct and independent colleges it was necessary for the Chemistry Department to adapt itself to this new organization and the requirements of these independent colleges. Two basic changes were made. The introductory courses were organized along different time schedules because the colleges were on different time schedules. Thus there was an introductory course of two semesters and an introductory
course of two terms. There were also special courses for special curricula. For example, a special course was organized for the students in Pharmacy, Ceramics, and the short courses.

The powerful influence of the various colleges was evident in the fight over the introduction of laboratory into the general chemistry course between Norton and the College of Agriculture and the College of Engineering. These colleges wished their students to have a laboratory experience in the introductory courses. When Norton resisted this idea they withdrew their students and an introductory chemistry course with laboratory was established in the Department of Agricultural Chemistry. In the case of the College of Agriculture there may have been an additional factor over and above the desire to have a laboratory experience for their students. There was probably a degree of competition and expansionism in the desire to have control of the basic preparatory areas of the curriculum. Once Norton was removed and laboratory was made a fundamental part of the introductory courses in the Department of Chemistry the students from the Engineering College returned. However the College of Agriculture continued to maintain a course in introductory chemistry and it was not until 1905 that the students in Agriculture returned to the Chemistry Department for the introductory chemistry. This was due to the dissatisfaction of the College of Agriculture Faculty with the kind of introductory course that
was being taught in the Department of Agricultural Chemistry. When the Agricultural Faculty was unable to force certain changes in the introductory course in that department they returned their students to the Department of Chemistry.

The competition between various subunits of the University, the desire of control over the preparation of students, and the ability of colleges to remove students from one department to another resulted in a duplication of effort. This situation was changed in 1908 when a policy was established to centralize all introductory courses in the appropriate department. This lessened the influence of the colleges in that they no longer could arbitrarily remove their students from a department and establish a competing course. At the same time it strengthened those departments which provided the introductory courses of a service nature by firmly establishing their perogatives as to control over these areas and assuring them a substantial enrollment base. The needs of the colleges and the different curricula was and is still met in the introductory courses but it is done by consultation between the department and the other university units. Today an examination of the introductory chemistry courses shows that there is an attempt to meet the needs of the various college and the curricula. There is a separate sequence of introductory courses for the students in the various engineering curricula. In another sequence of courses organic chemistry is provided to meet the needs of students in such curricula as nursing
and home economics. The basic control over these courses, however, is with the Department of Chemistry.

After the turn of the century large enrollments in the introductory chemistry courses began to make it necessary for the Department to offer multiple lecture sections in some of the courses. It was also necessary to offer courses in more than one quarter of the year to meet the needs of the students and the more complex scheduling situation which resulted from the large enrollments and the multiplication of courses and curricula. This trend has continued so that today there are as many as six different lecture sections of the same course being taught in the same quarter and in many cases each course offered by the General Chemistry Division may be taken in three and sometimes four quarters of the year. This has contributed to the need for coordination of these multiple sections.

Another factor which affected the organization of the introductory level chemistry courses was the need to adapt to the individual needs and background of the student. Sidney Norton, who worked with a relatively small number of students and devoted much time to individual instruction could readily adapt to the needs and ability of the individual student. However with increasing enrollments, the multiplication of the introductory courses, the large size of lecture sections, and the increasingly effective programs in high school chemistry at many secondary schools this method of dealing with different levels of preparation and ability was impossible. The
Chemistry Department and the departments of modern language were the first to adapt their courses to the high school background of the entering student. In 1903 the Chemistry Department offered special sections for students with little or no knowledge of chemistry and for students who presented chemistry as an entrance requirement. By 1910 the introductory chemistry courses were organized primarily on the basis of whether the student had had high school chemistry. One course sequence was designed for students without an adequate background in high school chemistry and the other for those who did. There was an additional sequence of courses but this was gradually phased out. It was designed for the students in the short courses and veterinary medicine.

The arrangement of courses based upon the student's level of preparation was possible because of the efforts toward coordination and consolidation that took place in the first decade of the twentieth century. The various colleges of the University coordinated their courses and their time schedules and their entrance requirements so as to reduce the duplication of effort. Attempts were made to correlate the college and high school programs. Cooperation arose between various colleges in the state and combined programs were developed which required a greater uniformity in the freshman and sophomore years. There was a movement away from the tendency for each professional program to require a special kind of introductory course for its students.
After World War I, the enrollment expanded rapidly as the ideal of a college education began to attract a broader spectrum of students. At the same time the University was expanding into graduate and professional education. It was not prepared to handle the needs of this broader spectrum of students and a crisis developed in the area of freshman education in the 1920's. There was a great deal of effort expended to adapt to the greater diversity of backgrounds and motivation among the students by providing student personnel services and giving greater attention to instruction at the junior level. One of the results was a trend toward sectioning students on the basis of ability. Another was the provision of general education type courses designed for students whose major field of study was not related to the course in question.

The provision of courses for students not majoring in a related area was not very successful at the time, although in recent years it has become an area of increasing importance. The Chemistry Department was among the first to use a placement test to segregate the students in its introductory courses on the basis of ability. It also attempted to introduce separate courses of a general education nature for non-science students in 1926, but these requests were turned down. By 1930 a system of sectioning developed whereby the students were divided into two groups on the basis of whether they had high school
chemistry. The group with high school chemistry was given a placement examination. The lowest students were placed with the students not having high school chemistry, the highest group was given an accelerated course. The remainder took the course designed for students with high school chemistry.

Today all of these factors can be seen in the present organization of the introductory courses. One sequence of courses is designed for students who have not had high school chemistry, for students who have a poor mathematics background, and for students in specific areas who need only a terminal sequence of courses. Another sequence is designed for students who have had high school chemistry, who have a good preparation in mathematics, and who need additional chemistry beyond the freshman level. Another sequence of courses is designed for students in engineering. Students may take proficiency tests and proficiency any of these courses. A final sequence of courses is designed for students of very high ability who score very high on the entrance examinations of the University and are invited to enter this sequence. There are today, as in the past, calls for still other sequences of courses for various special needs, such as a course for non-science majors. One of the major concerns of the Division of General Chemistry continues to be how to organize the introductory program in such a way that it can effectively and efficiently meet a variety of needs without fragmenting the program to an excessive degree.
The Administrative Organization of The Introductory Program

The manner in which the University and the Department of Chemistry has organized itself to provide the introductory programs has changed over the years. In the Norton era when there was only one introductory course, relatively few students, and no laboratory, one man, with the part-time assistance of students could coordinate the program. However by 1905 conditions had developed which led to the appointment of William L. Evans to the specific task of coordinating the General Chemistry Program. These conditions were:

(1) the large enrollments in the introductory courses.
(2) the development of a variety of introductory course sequences.
(3) the rise of multiple lecture sections for each course.
(4) the increasing use of junior staff in the teaching effort.
(5) the tendency toward increasing specialization and commitment to graduate education and research on the part of the faculty.
(6) the introduction of laboratory into the introductory courses.

These factors all required a greater deal of coordination of the program at the introductory level.

By 1925 the Department felt it was necessary to organize into subunits reflecting the areas of specialization in the Department and their differences. A separate Division of General Chemistry was
established at that time. Gradually over the years the Division has assumed greater and greater structure and complexity as it assumed an increasing share of the duties which were originally performed by the individual faculty members. Some of the duties now performed by the Division and its staff included: record keeping, scheduling, the maintenance of support facilities and personnel such as clerical staff, laboratory storeroom and preparation, television distribution system, and a lecture preparation operation; correlation with other university units; coordination of course content; supervision of the junior staff; and maintenance of the laboratory program and innovation in the instructional program.

At the University level there have been attempts to coordinate the introductory courses of a service nature on a broader basis than the departmental level. Many people felt that the nature of the introductory courses was sufficiently different from the goals and aspirations of the specialized departments that there should be a broader involvement in the operation of these courses than occurred at the departmental level. The efforts to organize the administration of these courses on a broader basis met with only limited success. A number of such attempts was made after 1925 and they can be summarized as follows:

(1) a movement toward the creation of a separate university-wide junior college structure to handle the freshman and sophomore years.
(2) the creation of junior divisions in a number of colleges to coordinate the work of the freshman and sophomore students within those colleges.

(3) the attempt to form cooperative, voluntary organizations of similar departments to coordinate their introductory programs.

(4) attempts at cooperative teaching efforts among the faculty of individual departments.

All of these efforts were unsuccessful primarily because of the lack of cooperation of the department faculties. The movement to establish a separate university-wide junior college organization was rejected by the faculty. Instead junior divisions were established and although one of their purposes was to coordinate and supervise lower division instruction, this was resisted effectively by the departments and the junior divisions and their deans concentrated on student personnel services. The voluntary organizations which were authorized in the College of Arts and Sciences between similar departments never developed because of the lack of interest. The same can be said of attempts such as that of Evans who organized a course based upon cooperative teaching by faculty members from a number of related departments. The movement to broader control has continued in various forms over the years, but it has never effectively weakened the control of the specialized departments over their introductory courses. Today a University College organization exists, but it
merely performs the functions of the old junior divisions, except on a broader basis. It's primary concern is with the adjustment of the student during the freshman and sophomore years of college life. It exercises little influence over the courses taught at the introductory level.

**The Effect of Other Goals on The**

**General Chemistry Division**

The rise of research and graduate education to the central position of the University has had a great effect on the character of the introductory programs. It has resulted in the following:

1. a periodic neglect of freshman instruction
2. a lowering of the status associated with freshman instruction
3. a tendency on the part of the faculty to avoid freshman teaching and supervision
4. the use of inexperienced and temporary staff in the introductory program

These conditions have resulted in part because of the following:

1. Incentives such as promotion, salary increases, recognition by ones peers, and status is associated with research productivity, graduate teaching, and low teaching loads.
2. The resources and incentives to encourage instructional excellence in the introductory programs has not been provided by the institution.
(3) Resources have not been available to expand the senior faculty so that teaching loads could be lowered to a level consistent with the needs of research and graduate education and at the same time maintain a high contact with the introductory programs.

(4) The specialized nature of the faculty members research and teaching interests has become further and further removed from the broad instructional concerns of the introductory programs.

(5) The availability of a cheap labor source in the form of graduate students has allowed the senior staff to lower its contact with the introductory program and student.

(6) The lack of strong leadership on the part of the administration of the institution in combating some of these negative tendencies in the introductory programs.

The Chemistry Department has experienced these factors and conditions in its attempt to provide quality instruction in the introductory level and to build a successful program of graduate education and research. The basic problem of gaining the participation of a broad segment of the faculty in the introductory program has been identified by a variety of people as the major problem in the introductory program.
Over the years there has been a definite trend away from senior staff participation in the program as the resources available for research and graduate education expanded. At the same time there has been an increase in the duties which are performed by the junior staff and various support staff members of the General Chemistry Division.

The only duties which a senior staff member need perform if he chooses when teaching introductory chemistry are giving the lectures, preparing examinations, and deciding on the numerical ranges for the final letter grades. The supervision of assistants, coordination of the laboratory program, the preparation of demonstrations and the many other duties associated with large courses in chemistry can be handled by the Division staff. There are even people who wash the chalk boards prior to each lecture. It is the feeling of this author that as a result of the lower degree and quality of contact with the introductory program and students there is a danger that the faculty may lose an understanding of these areas. To an increasing extent even the lectures in the introductory courses are given by temporary staff members. This is also true of the development of innovations and techniques and devices in the program. Since the senior faculty exercises control over the introductory program this increasing lack of contact and understanding of the program could result in a lack of adequate support for the program.
The quality of instruction in the introductory program in chemistry was maintained at a high level despite some of the negative aspects resulting from the emphasis on specialization, research, and graduate education because of the following conditions:

(1) the leadership and support of the introductory program by the Department Chairman

(2) the quality of management of the Division of General Chemistry by various people over the years.

(3) the overall quality of the Department which enabled it to have the resources necessary for excellence in a variety of areas.

(4) the tradition of teaching excellence and concern established by McPherson and Henderson and continued through the years by numerous people.

It seems to this writer that the leadership and example set by the Department Chairman in supporting the introductory program has been very crucial. McPherson and Evans were both strong, somewhat autocratic leaders who had a strong commitment both to undergraduate instruction and to research and graduate education. They provided the leadership to counteract the tendency of the faculty to move out of contact with the introductory programs by their examples and leadership. After the Evans Era the position of the department
chairman was somewhat weakened because of the establishment of a limited tenure chairmanship and the introduction of the policy of greater consultation of the faculty in the management of the departments. While it may be coincidental, it seems that the department chairman which followed Evans have not been able to provide the kind of strong leadership which seems necessary to counteract some of the negative tendencies in the instructional program. Certainly this is to some measure due to the preferences and attitudes of the person who is chairman but it also was due to the greater faculty voice in the decision making processes of the department. Edward Mack, who followed Evans as chairman, was a good teacher and interested in the freshman student on a individual basis. Nevertheless he allowed the faculty to limit their teaching to their speciality if they so desired, a policy which Evans strongly resisted. Mack also was chairman when the faculty gave up the teaching of recitations which further lowered their contact with the introductory student program. Garrett, who was deeply committed to the introductory program and ran it for many years, was a strong leader but he had only limited success in developing greater faculty interest in introductory instruction while he was chairman, although his term was short. There has been an erosion of the tradition of teaching excellence in the introductory program. Fewer and fewer senior staff members are participating in the program and when they do participate it is usually limited to lecturing.
It seems apparent then that some conflict does exist between the goals of the introductory program and those of research and graduate education and this has resulted in the development over the years of a separate organization within the Department to provide these programs. At the same time there has been a trend away from senior staff participation in the introductory teaching program. Yet the introductory program is still primarily controlled by people who have a more substantial vested interest in an area which competes in an extent with the introductory program for the time, energy, and resources in the Department. This situation does not seem to this author to be the best possible arrangement. Some method of bringing broader control to these kinds of courses should be explored.

Concluding Statements

Some of the observations which have been made concerning the areas of interest to this study can be summarized as follows:

(1) The methods used in the introductory courses have not changed greatly since laboratory was introduced into the program.

(2) The organization of the introductory courses is affected by the background and ability of the students, the needs of the various colleges and their curricula, and the necessity of handling large numbers of students.

(3) An administrative organization for the introductory chemistry program was initiated and developed over the
years because of the large enrollments, the variety of introductory courses, the need to supervise the large junior staff, and the need for efficient instruction to free the faculty for other pursuits.

(4) There have been a variety of attempts to coordinate the introductory courses on a broader basis than the departmental level but these attempts have largely failed.

(5) The development of the research and graduate program of the University together with the limited resources available to the University has resulted in some negative effects on the introductory programs.

(6) The Chemistry Department maintained a quality introductory program over the years because of strong leadership by various department chairman in support of the program, a tradition of teaching excellence established early in the departments history, the availability of the resources to pursue a variety of goals, a strong level of management of introductory program, and the availability of a core of good teachers who were willing to spend time improving the introductory program.

The use of historical research of departments and related areas can effect a better understanding of this important level of university activity. Present day conditions do not just appear but develop
because of a complex set of factors many of which have their origin in the past. Attempting to understand what has occurred in the past can lead to a better understanding of the present and allow decisions to be made on a firmer basis. This points up the need for Universities and their subunits to maintain good records of their activities. While for the most part the records of the University Archives and the Chemistry Department provided adequate source material for this paper, it became increasingly difficult to find material concerning the Department itself after 1942 because inadequate records of Departmental activities of a non-statistical nature were retained in the Department and the record retained by the University did not contain the wealth of detail about the activities of individual departments because of the increasing complexity of the University. It is to be hoped that the University will encourage its subunits to maintain better descriptive records of the activities.

This study points up the need for further research in the area of introductory programs and the other activities of university departments. There should be an examination of the introductory programs of the other departments and the role of departments at other levels of endeavor. An investigation of the nature of the reward structure, the influence of non-permanent staff members on the introductory program, evaluation of other mechanisms of control
over introductory programs, and a testing of the hypothesis held
by many faculty members that the best introductory instruction is
given by people actively engaged in research in the discipline
would be useful. Perhaps of special interest would be a study of
the role of the deans, department chairman, and the division heads
in the administration and encouragement of the introductory programs.
SELECTED BIBLIOGRAPHY


Board of Trustees of the Ohio Agricultural and Mechanical College. Annual Reports of the Board of Trustees, 1870-1877. Columbus, Ohio: News and Meyers, State Printers, 1877.

Board of Trustees of the Ohio State University. Annual Reports of the Board of Trustees to the Governor of the State of Ohio. Columbus, Ohio: State Printers, 1882-1960.


Caley, Earle R. History of the Department of Chemistry. Columbus, Ohio: The Ohio State University Department of Chemistry, 1970.


Fernelius, W.C., Quill, L.L., and Evans, W.L. "Experiences Teaching Proficiency Students in Chemistry". Journal of Chemical Education, XIV (September, 1937), 427-433.
Garrett, A.B. private interview. Columbus, Ohio: (December, 1972).


Garrett, A.B. and Fawcett, H. "Our Students Do Not Know Arithmetic". Ohio Schools, XXII (1945), 200.


The Ohio Agricultural and Mechanical College Faculty. "Faculty Records, 1873-1882". The Ohio State University Archives.

The Ohio State University. Catalogue for 1896-1897. Columbus, Ohio: The Ohio State University, (1896).

The Ohio State University. Faculty and Staff Directory, 1915-16. Columbus, Ohio: The Ohio State University, (1915).

The Ohio State University. Department of Chemistry. "Records of General Chemistry Notices, 1922-23". The Chemistry Department Archives.

The Ohio State University Faculty. Central Committee on the Freshman Problem. "Report on a Proposed Junior Division of the University". The Ohio State University Archives, (May 31, 1927).

The Ohio State University Faculty Council on Instruction. "Council Minutes". The Ohio State University Archives, (1926-1960).

The Ohio State University Faculty "Special Faculty Committee on Departmental Organization, Procedures, and Control. Final Report". The Ohio State University Archives, (1940).

The Ohio State University Faculty Council. "Faculty Council Minutes". The Ohio State University Archives, (1934-1960).

103 OL 662-663.


The University Faculty of the Ohio State University. "Faculty Records". The Ohio State University Archives, (1883-1933).
