A STUDY OF SUBJECT MATTER IN
TWO GROUPS OF BIOLOGIES

by

Edith Babb,
A. B. The University of the
State of Kansas 1915.

Submitted to the Department of
Education and the Faculty of the
Graduate School of the University
of Kansas in partial fulfillment
of the requirements for the degree
of Master of Arts.

Approved by:

June 24, 1930.
ACKNOWLEDGEMENT.

The writer wishes to express her appreciation for the helpful suggestions given her in this study by Dr. J. W. Twente, Professor of Education of the University of Kansas.
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A STUDY OF SUBJECT MATTER IN
TWO GROUPS OF BIOLOGIES.

Chapter I.

INTRODUCTION.

Historical Setting.

The first secondary school in this country was the Boston Latin Grammar School, established in the year 1635. It was a replica of the Latin Grammar School of England and offered the characteristic classical course and a study of the Scriptures. Certain men disliked this type of school with its narrow theoretical viewpoint, and suggested in its place an entirely new type which would promote a broader, more democratic spirit and inculcate the practical ideals of American life.

Their hopes were realized by the establishing of Academies about the time of the American Revolution and they maintained an important place in secondary education until about 1875.

Benjamin Franklin proposed the first academy and it was established in 1751 under the name of the Philadelphia Academy. The growth of the academy was enormous. By 1800 there were at least 30 in North Carolina, 21 in Virginia, 20
in Massachusetts, 14 in New York, 12 in Pennsylvania and similar numbers in the other states. In 1858 New York state alone had 50 incorporated academies, three of which taught botany. Between 1821 and 1864 the academy held a dominant position in secondary education, and academies were very popular for they attempted to prepare students for the practical needs of life. However, the special aim for biology at this time was "to impart certainty to the mind and religion to the heart."

Massachusetts, the pioneer in the high school movement, established secondary schools by law in 1677. The aim of these schools was only to prepare students for college. No biology was taught. The period between 1821 and 1846 saw the rise and expansion of public high schools throughout New England and between 1821 and 1849 there was much experimentation and standardization with the result that the fundamental principles of high school policy were then established.

A new aim borrowed from the academy became evident in the purpose of the high school course; namely, preparation for life activities as well as for college entrance. Religious motive was prominent in science teaching and a science was studied chiefly as a means of showing the divine power of the Creator. Zoology was given in Wesleyan Academy, Wilbraham, Massachusetts in 1818, and was first introduced in the high school
curricula about 1825.

During the early part of this period biology was taught only in a few schools. Public and common schools excluded it entirely because it was believed to be useless. In 1827 the Rensselaer Institute was founded for the purpose of teaching science in its application to life. Natural History was taught chiefly from text books from its introduction until 1865. Ruschenberger's series of zoology texts were among the first employed in teaching this subject. Great numbers of animals were studied. The highest forms were studied first, the lowest last, and classification was the basis of study. It was taught arbitrarily at the beginning of the course before the pupils had any conception of its meaning. While zoology placed emphasis upon the study of the natural history of animals, botany courses began with an intensive study of morphology and technical names. In 1850 Massachusetts made the teaching of physiology compulsory in all the elementary schools of that state.

Beginning in 1870 zoology teaching adopted a new fashion which continued for about 15 years. A comparative anatomy course was offered. The course still served to inculcate religious ideals. Morphology was becoming increasingly important. Careful observations to obtain natural affinities became the leading aim of the course. Cotton's Practical Zoology was the first definite attempt to survey the whole animal kingdom by means of selected types. This book revolutionized zoology teach-
ing and was the leading text until Boyer's Laboratory Manual in Elementary Biology, including both zoology and botany in one course.

From 1865 until 1890 the influence of the academy waned while that of the high school increased. The disciplinary value of biology was recognized even by those devoted to library studies. Classification, drawing and real laboratory work became important elements of the course and a popular demand for biological knowledge grew. From 1891 till the present time the high school dominated, science enrollments decreased, but biology held the leading place among the sciences. The need for the interpretation of facts and the study of the significance of vital processes was felt. The biology of man in its social and economic aspects was studied. Committees and specialists attempted to organize biology courses which would function in the lives of students. W. A. Locy says, "No one can follow the history of the rise of biological ideas without being convinced that the interpretations of nature from some biological analysis have freed the human spirit from some traditional hindrances to development and have played an important part in intellectual progress." The various applications of biological discoveries to the welfare of mankind supply


one of the most striking examples of benefits accruing from investigations in pure science.

Chapter II.

GENERAL PROBLEMS.

Biology Contents and Aims.

1. Botany was offered in New Salem Academy in 1795, and in 1829 an article appeared in the American Journal of Educational Botany for Schools. The following values were claimed for botany:

1. Interesting and delightful occupation for youthful minds. Shows beauty of works of Creator.
2. Adds interest and utility to our journeys and walks.
3. Healthful exercise (botanical excursions).
4. Attentive and accurate observations.
5. Habits of order.
6. Practical use for medicine, geology and entomology.
7. Promotes moral thoughts, nearest to astronomy in this respect.
8. Very satisfactory subject to teach girls.

The study of plants for purpose of classification met with a reaction when many objected to Darwin's views concerning evolution. Parts of texts referring to evolution were frequently omitted. The botany course became chiefly a disciplinary subject. Laboratory hours were increased about 12 per week in 1890 so that many careful drawings could be made by the student.

1. Finley's, "Biological Sciences in the High School". p. 13.
However, the biology taught was inadequate, the course was too short, and the teachers poor. The first suggestion came from a committee of ten appointed by the National Educational Association, the actual statement of the committee being:

"Resolved, that it is the judgment of the conference that while the principles of hygiene should be included in the work of the lower grades, the study of physiology as a science may best be pursued in the later years of the high school course. We recommend that in the high school a daily period, for one year, be devoted to the study of anatomy, physiology, and hygiene, with as large an amount of practical work as it is possible.............. That a minimum of one year's study of natural history be required in high school, and that at least three-fifths of the time should be employed in laboratory work. That the general comparative morphology of physiology and anatomy be recommended as the part of the natural history most suitable for study in the secondary schools. That in the primary and grammar grades there should be a study of gross anatomy and in the secondary school a study of minute anatomy."

"That the year's work in natural history, as outlined for the high school, be required for entrance to college in every course. That differentiation appears to be unwise and therefore not desirable.............. That at least one-fourth of the high school should be devoted to nature studies,
and that this amount of preparation should be required for entrance to college."

Bergen's Elements of Botany appeared in 1896 and Parker and Haswell's Manual of Zoology was published in 1900. Both were popular and are still in use today. After 1900 both botany and zoology were subjects primarily interested in principles and not in things.

In the Board of Regents' 1905 syllabus it was recommended that all schools having adequate laboratory equipment and teachers of requisite scientific training give a first year course in biology consisting of some study of botany, zoology, and human physiology. The reasons given were that the interests of students are extensive, rather than intensive, and that the essentials of life phenomena require study of both plants and animals.

The New York syllabus sought to unify the course in 1910 by selecting and emphasizing those topics which are of general biological importance.

The aims of the biology course were:

1. First hand knowledge of common plants and animals.
2. Some understanding of essential functions carried on in living things.
3. Economic importance of plants and animals.
4. Individual and public health.

In 1920 the National Educational Association appointed a committee to reorganize the science curriculum.

The cardinal aims of biology were considered to be represented in the development of:

2. Command of fundamental processes.
3. Worthy home membership.
4. Vocational interests.
5. Citizenship.
7. Ethical character.

A high school conference which met at the University of Illinois thought the following aims to be the most important.

1. To give the students a vital interest in plants and animals.
2. To show the human values of plants and animals.
3. To form a problem solving habit concerning plants and animals.
4. To develop some ability in the use of the library, field and laboratory.
5. To be able to sustain interest in plants and animals over long periods.
6. To show the effect of response to environment.
7. To give some conception of evolution sequence.
(8) To give some experience in classification of organisms.

(9) To have an open minded viewpoint towards evolution.

(10) Sex education.

Aims for high school biology as the result of a questionnaire are reported in School Science and Mathematics, March 1923, page 253.

The aims in order of greatest frequency are:

(1) To train in accurate observation.

(2) To reason.

(3) Biology as a leisure study.

(4) To study the environment biologically.

(5) To know one's body by a study of plants and animals.

(6) Citizenship.

(7) Civic biology.

During the last ten years a new type of biology course has developed. The content is not treated as two distinct sciences but botany and zoology are integrated, such material being selected from either the plant or the animal kingdom as will best demonstrate the fundamental characteristics of living organisms and the generalization of biology. No new texts in botany or zoology in the last ten years indicate that general biology will have a permanent place.

School and Society for March 24, 1923, contains the report of a study made by Charles W. Findley and Otis W. Caldwell of the Lincoln School of Teachers College of Columbia University on the Biology of the Public Press.

"The articles found are of the same general types in all parts of the country, with local variations readily accounted for by special local situations."

"Health biology, which appears in largest quantity, thus relates interestingly to recent conclusions reached by national educational committees to the effect that health is the first aim of education."

"Biology pertaining to health, animal life, plant life and food is easily the dominant biological interest of the public, as far as this investigation presents dependable data."

W. O. Lacy says, "The various applications of biological discoveries to the welfare of mankind supply one of the most striking examples of benefits occurring from investigations in pure science. . . . . . . . . That the great generalizations of biological science have been derived from the study of both plants and animals . . . . . . . . and that biological progress should rather be represented as a stream of thought than as a mere accumulation of facts about animals and plants."

I. Caldwell, Otis, School and Society, Mar. 24, 1923.
Chapter III.

SPECIFIC PROBLEMS.

(a) Purpose of the Study.

This study proposes to compare the biological content of two groups of biology books, one group being five books published between 1889 and 1913, the other five published in 1924, 1925 and 1926.

An attempt will be made to compare the number of chapters, number of subjects, number of illustrations, and total number of square inches of reading material in each book and then in the two groups.

The purpose or aims as may be revealed in these books will be observed, and aims for biology from educational studies or investigations made during these periods will be studied. No other studies in the field of biology comparable to this have been made so far as the writer is able to learn, but two studies related in method and purpose in different fields offered valuable suggestions as to procedure.

(b) Studies Related in Method and Purpose.

1. Florence Fuller with the cooperation of all the mathematic teachers in Los Angeles set up criteria for judging mathematics texts. Many committees composed of teachers studied the contents of texts in every detail. Number of
illustrations, types of illustrations, space in square millimeters occupied by illustrations, type, spacing between letters, words and line, average difficulty of vocabulary for each text were obtained and space in square millimeters occupied by printed matter, data as to authors, degree, college, grade, years, place and position they hold, indicate the searching study made and published in book form in 1928.

2. Luella Cole Pressey of Ohio State University reports that during the summer of 1925 one of the author's classes worked out some simple investigations of text books. Each student worked on a different plan, but the studies were similar because the texts selected represented publications over a number of years. No particular effort was made to find the one or two most widely used books during any period, as the study was only a preliminary skirmishing to determine methods of arranging a historical study of text books. It is with the hope that others may find these simple methods suggestive that the results are published.

How much space is devoted in histories to characterizing important individuals? Those individuals were selected, names appeared everywhere in the histories in a paragraph heading. She counted the number of lines given to describing these "important" individuals in three texts published respect-

ively in 1897, 1908 and 1924. The most recent book shows a decrease in the number of individuals mentioned prominently, but none of these texts endeavors to acquaint children with the character and individuality of our national heroes.

How many dates per page to histories usually have? Five histories of the United States were selected. The dates on every tenth page were counted and the total number averaged for each book.

One member of the class studied the types of problems on the increase in arithmetic texts by examining every fifth page and tabulating the number of problems under four headings.

What kinds of maps and other illustrations appear in geographies? .........

Is the vocabulary of readers becoming easier? ......

What changes have taken place in the content of fourth-grade readers? ......

The content of each reader was analyzed to find the amount of space given to different types of writing and to various types of subject matter. Results presented in a table....

Changes in subject matter noted. Poetry has decreased from 26.6% to 5.2%............. Biblical stories have vanished. Change in aim............. facts show the reader is changing from the old idea of teaching declamation and morality to the new idea of teaching comprehension and appreciation........... Gradual improve-
ment in the sincerity of subject matter......The modern readers attempt not only to teach rapid comprehension of immediate material but direct future reading.

(c) Method of Procedure Followed Here.

Five biology books published in as early a period as could be found were secured, likewise five from as late a period. An attempt was made to compare each book with others in a group, and then the two groups were compared in the same manner.

A similar table for each group was made, where the number of chapters, chapter subjects, number of illustrations and total number of square inches in printed content were noted. According to the chapter subjects the percentage devoted to each branch of biology was computed. Each chapter subject was considered under that branch of biology to which its subject referred; any subject referring only to plants being classified as botany, any subject referring only to animals, as zoology; any subject referring to the physiology of the human body, as physiology. All other chapter subjects were considered as General Biology. All chapters referring to bacteria were considered under General Biology.

According to the subject matter as denoted by chapter subject, duplications are made on the chart of each group by placing those chapter subjects, on the same horizontal line, in separate columns. In this way duplications between the books

in each group may be noted and also the duplications between the two groups.

An effort to choose the outstanding characteristics of any book or either group was made, and from these observations trends in the field of biology sought.
Chapter IV.

AIMS IN EARLY GROUP TEXTS AND IN LATER GROUP TEXTS.

A. A study of the aims for Biology as found in the preface and introduction of the books in the two groups follows:

A. Early group.

1. Huxley and Martin
   Haws and Scott 1875 1889
   "Preparatory discipline to serve as a practical introduction to the study of human anatomy and physiology for students of medicine".

2. Sedgwick and Wilson 1895
   "Afford a basis for future studies in Biology. Affords a better knowledge of vital phenomena."

3. Needham 1910
   "Acquire a real knowledge of living nature. Some comprehension of biological principles is just becoming a part of the common intelligence.
   "The fundamental relations that general biology bears to a whole wide range of special sciences."
4. Parker 1911

"Aims to familiarize student with ideas of science....Modifications of structure and chief physiological processes in plants and animals.

"Introduces biogenesis and evolution."

5. Bigelow 1913

"Aims to introduce facts and ideas, bearing on the daily life of intelligent citizens applicable to human life in economic, or practical and hygienic lines".

B. Later Group.

1. Peabody and Hunt 1924

"Aims to stress function rather than structure - comparative studies of plants and animals. Aims to stress biology in relation to human welfare".

2. Moon 1924

"Aims to state broad general truths---emphasizes the fact that biology is a unit science based on the fundamental idea of development rather than a combination of botany, zoology and hygiene."
"The high school is no longer primarily or chiefly a college preparatory institution. Many for whom the subject can be most interestingly and most profitably developed in terms of our every day affairs emphasizes applications of science to human affairs in all three parts of the book."

"Getting acquainted with life".

"Biology of Health".

"Biology of Wealth".

4. Kinsey 1926

"Aims to apply biologic principles to incidents of every day life."

"Treats distributional biology and behavior. Presents material on metabolism, epidemics, simple instinctive and intelligent behavior and the formulation of the scientific method".

5. Waggoner 1926

"Aims to treat those phases of biology directly related to human welfare."

"Long discussions of structure omitted in order to avoid repetitions so often met in courses based upon both text book and laboratory materials."
Briefly summarizing these extracts for comparison I find the aims to be as follows:

a. Early group.
   1. Preparatory.
   2. Preparatory.
   3. Understanding of biological principles.
   4. Structure and function.
   5. Biology in relation to daily life.

b. Later group.

   1. Biology in relation to daily life.
   2. Broad general truths.
   5. Biology in relation to daily life.

In the early group only one author clearly defines his aims for Biology as being related to Human Life. Four in the later group definitely relate the subject matter to our every day affairs.

B. An attempt to present a study of the subject matter in each book and a comparison of the subject matter in the two groups is made on the following charts in tabulations, and a graphic presentation of these charts complete the findings.
# A Study of Two Groups of Biology Text Books

<table>
<thead>
<tr>
<th>Name of Book</th>
<th>Author</th>
<th>Publisher</th>
<th>Date</th>
<th>No. Chapters</th>
<th>Subjects</th>
<th>No. Illus. &amp; Diagrams</th>
<th>No. Chapters Microscopic</th>
<th>Non-Microscopic</th>
<th>Total No. Sq. Inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Practical Biology</td>
<td>Huxley Martin</td>
<td>Macmillan</td>
<td>1875</td>
<td>16</td>
<td>16 (?)</td>
<td>None</td>
<td>8</td>
<td>8</td>
<td>73,541.99</td>
</tr>
<tr>
<td>3. Gen. Biology</td>
<td>Needham</td>
<td>Comstock P. Co.</td>
<td>1910</td>
<td>7</td>
<td>5 (?)</td>
<td>256</td>
<td>1</td>
<td>6</td>
<td>71,187.34</td>
</tr>
<tr>
<td>5. Intro. to Biology</td>
<td>Rigelow</td>
<td>Macmillan</td>
<td>1913</td>
<td>12</td>
<td>10 (?)</td>
<td>117</td>
<td>1</td>
<td>11</td>
<td>75,176.45</td>
</tr>
<tr>
<td>7. Bio. for Beginners</td>
<td>Moon</td>
<td>Holt &amp; Co.</td>
<td>1924</td>
<td>54</td>
<td>84 (?)</td>
<td>165</td>
<td>4</td>
<td>50</td>
<td>8,792.96</td>
</tr>
<tr>
<td>8. Bio. &amp; Human Life</td>
<td>Brinenberg</td>
<td>Ginn &amp; Co.</td>
<td>1925</td>
<td>51</td>
<td>4 (?)</td>
<td>243</td>
<td>1</td>
<td>50</td>
<td>9,727.00</td>
</tr>
<tr>
<td>9. Intro. to Biology</td>
<td>Kinsey</td>
<td>Lippincott</td>
<td>1926</td>
<td>45</td>
<td>84 (?)</td>
<td>430</td>
<td>1</td>
<td>44</td>
<td>7,303.14</td>
</tr>
<tr>
<td>10. Modern Biology</td>
<td>Waggner</td>
<td>Heath &amp; Co.</td>
<td>1926</td>
<td>15</td>
<td>8 (?)</td>
<td>545</td>
<td>3</td>
<td>12</td>
<td>8,774.16</td>
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<td>528,398.30</td>
<td>326,398.30</td>
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</tbody>
</table>

- Early Group
- Late Group
<table>
<thead>
<tr>
<th>Chapter Subject</th>
<th>Chapter Subject in the First Group</th>
<th>Chapter Subject in the Second Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The Frog</td>
<td>1. Living Matter</td>
<td>1. Interdependence of Organisms</td>
</tr>
<tr>
<td>2. Freshwater Crayfish</td>
<td>2. Structure of Living Things</td>
<td>2. The Simpler Organisms</td>
</tr>
<tr>
<td>5. Freshwater Mussel</td>
<td>5. Living Matter</td>
<td>6. Prin. of Classification</td>
</tr>
<tr>
<td>6. Freshwater Polypes</td>
<td>6. Organism Studies</td>
<td></td>
</tr>
<tr>
<td>7. The Boll Anineule</td>
<td>7. The Biology of an Earth Worm</td>
<td></td>
</tr>
<tr>
<td>8. Protans Anineule</td>
<td>8. The Biology of an Earth Worm</td>
<td></td>
</tr>
<tr>
<td>11. Spirogyra</td>
<td>11. Unicellular Organisms</td>
<td></td>
</tr>
<tr>
<td>12. Bacteria</td>
<td>12. Unicellular Animals, amoeba</td>
<td></td>
</tr>
<tr>
<td>15. The Broken Fern</td>
<td>15. Unicellular Plants, Bacteria</td>
<td></td>
</tr>
</tbody>
</table>

Chapter subjects in this group duplicated in the second group No. 16.
23 Chapter subjects not duplicated in the second group.

Chapter subjects in this group duplicated in the second group No. 16.
23 Chapter subjects not duplicated in the second group.

Chapter subjects in this group duplicated in the second group No. 16.
23 Chapter subjects not duplicated in the second group.

Chapter subjects in this group duplicated in the second group No. 16.
23 Chapter subjects not duplicated in the second group.

Chapter subjects in this group duplicated in the second group No. 16.
23 Chapter subjects not duplicated in the second group.

Chapter subjects in this group duplicated in the second group No. 16.
23 Chapter subjects not duplicated in the second group.

Chapter subjects in this group duplicated in the second group No. 16.
23 Chapter subjects not duplicated in the second group.
4. Inheritance
5. The Life Cycle
6. Adjustment of Organisms to Environment.
7. The Responsive Life of Organisms.

1. Hereditary
2. Hematococcus
3. Heteromita
4. Engima
5. Prototaxa and Mycotaxa
7. Biogenesis and Abiogenesis
8. Homogenesis and Heterogenesis
9. Paramycelia
10. The Life Cycle
11. The Shell
12. Nucor
13. Venehemia and Gauerpa
14. Distinctive Characteristicsof Animals and Plants
15. Homostromatellae & Ulv
16. Gymnosperm & Cogemnica-
17. Maturity & Imprinting of Fruit
18. Polygardius
19. Chief Divisions of Animal Kingdom
20. Dogfish
21. Moosae
22. Chief Divisions of Vegetable Kingdom
23. Angiosperms
24. Gymnosperms
25. First lessons in Plant Biology
26. Work of the Organs of a Plant
27. Study of Insects
28. Some Animal Studies Preliminary to Human Biology
29. Human Structure and Life Activities
30. Biology Applied to Personal Hygiene
31. Organisms That Affect Human Health
32. Plants That Affect Human Health
33. Economic Relations of Organisms
34. Reproduction of Organisms

Summary: 57 chapter subjects in the Early Group.
Total number of square inches = 885,131.79.
<table>
<thead>
<tr>
<th>Peabody and Hunt</th>
<th>Moon</th>
<th>Greenburg</th>
<th>Kinsey</th>
<th>Waggoner</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> The World We Live In</td>
<td></td>
<td></td>
<td>2. Where Food Comes From</td>
<td></td>
</tr>
<tr>
<td><strong>2.</strong> Of What Our Foods Are Made</td>
<td></td>
<td></td>
<td><strong>7.</strong> Living Structures</td>
<td>Animals</td>
</tr>
<tr>
<td><strong>3.</strong> How Plants Manufacture Food</td>
<td></td>
<td></td>
<td><strong>8.</strong> Animal Structures</td>
<td></td>
</tr>
<tr>
<td><strong>4.</strong> How Living Things are Able to do Work</td>
<td></td>
<td></td>
<td><strong>9.</strong> Plant Structures</td>
<td><strong>1.</strong> Food in Relation to Plants &amp; Animals</td>
</tr>
<tr>
<td><strong>5.</strong> How Living Organisms are Constructed</td>
<td></td>
<td></td>
<td></td>
<td><strong>4.</strong> Foods and their Use</td>
</tr>
<tr>
<td><strong>6.</strong> What We Should Eat and Why</td>
<td>37. Food</td>
<td></td>
<td><strong>9.</strong> The Meaning of Food</td>
<td><strong>10.</strong> Nutrition and Health of Human Body</td>
</tr>
<tr>
<td><strong>7.</strong> How Drugs &amp; Beverages Affect Us</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td><strong>8.</strong> How Foods are Prepared for Use &amp; Distribution</td>
<td>38. Nutrition</td>
<td><strong>13.</strong> What to Eat</td>
<td><strong>14.</strong> Using Foods and Protoplasm</td>
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<td><strong>9.</strong> How Water and Other Substances are Distributed in Plants</td>
<td><strong>11.</strong> How Food is Taken In</td>
<td><strong>15.</strong> The Cycle of Life Flowers</td>
<td><strong>16.</strong> Reproduction</td>
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<td><strong>10.</strong> How Human Body is Fitted for Digestion and Food</td>
<td><strong>12.</strong> Working over the Body's Income</td>
<td><strong>17.</strong> Reproduction Flowers</td>
<td><strong>17.</strong> Reproduction Flowers</td>
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<td><strong>11.</strong> How Cir. is Carried on in Human Body</td>
<td>42. Multiplication in Plants</td>
<td><strong>18.</strong> Bacteria</td>
<td><strong>18.</strong> Bacteria &amp; Disease</td>
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<td><strong>12.</strong> How Living Organisms Breath</td>
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<td><strong>19.</strong> How Diseases are Caused.</td>
<td><strong>19.</strong> Bacteria &amp; Disease</td>
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<td><strong>13.</strong> How Certain Things Produce</td>
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<td><strong>20.</strong> Microbes and their control</td>
<td><strong>20.</strong> Plant as a Whole (Corn)</td>
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<td><strong>14.</strong> How Flowering Plants Reproduce</td>
<td>14. Flowers, Pollination and Fertilization</td>
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<td><strong>15.</strong> How Plant Propagation is Carried on</td>
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<td><strong>16.</strong> How Microscopic Org. are Related to Health and Disease</td>
<td>17. Bacteria</td>
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<td><strong>17.</strong> How Plants are Related to Human Welfare</td>
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<td>22. How Diseases are Caused.</td>
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<td><strong>18.</strong> How Fishes are Related to Human Welfare</td>
<td>24. Zoos, Zoology</td>
<td>20. Microbes and their control</td>
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<td><strong>19.</strong> How Insects are Related to Human Welfare</td>
<td>25. Insects &amp; Disease</td>
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<td><strong>20.</strong> Insects in Relation to Disease</td>
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<td><strong>21.</strong> Insects in Relation to Disease</td>
<td>26. Insects &amp; Disease</td>
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<td><strong>22.</strong> Insects &amp; Disease</td>
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</tbody>
</table>
51. Tobacco & Table Beverages
52. Alcohol in Relation to Biology
53. Some General Biologic Processes
54. Historical Development of Bio.

3. Some Life Relationships - Butterflies and Bees
7. The Sorting of Plants and Animals
15. The Air
16. Hygiene of Blood & Circulation
20. The Skin & Its Appendages
24. Hygiene of Sense Organs
25. Instincts and Habits
26. The Emotions
28. Human Organism, Keeping it Fit
33. Artificial Immunity in Control
35. The Home in Relation to Health and Disease
36. Industrial Problems of Health
40. Classes of Plants and Their Economic Importance
41. Classes of Animals and Their Economic Importance
42. Multiplication in Animals
44. Improving Qualities in Plants and Animals
45. Plant Breeding
46. Animal Breeding
47. Earth, The For Mankind
49. Insects in Relation to Human Wealth
51. People in Relation to Earth

44 & 45. History of Biology
56. Simple Behavior 57. Instincts
58. Plant Groups
6. Animal Groups

59. Intelligent Behavior
6. Taxonomists as Explorers
11. Embryology
13. Human Hygiene
16. Heredity
17. Heredity and Environment
18. Value of Scientific Research
19. New Kinds of Organisms
20. Further Evidences of Change
21. Fossils
22. Ecologic Relations of Organisms
23. Epidemics
8,669.28 square inches 8,709.96 square inches
27 chapters 34 chapters
(Phy. .16%) (Phys. .21%)
(Dot. .19%) (Bot. .29%)
(Zoo. .28%) (Zoo. .35%)
Gen. Bio. .35% (Gen. Bio. .35%)

Summary:

109 chapter subjects in Late Group. Total number square inches = 43,286.61
154 = Total number chapter subjects

Comparison of two groups —

First Group = No. square inches = 287,123.79
Second Group — No. square inches = 43,286.61
Total No. square inches = 330,400.40
Difference in No. square inches = 287,123.79

26 chapter subjects in First Group not duplicated in Second Group.

Number square inches in First Group 6.543 times as large as in the Second Group.
Number square inches in First Group equals 95% of the Sum Total of square inches or 40944.
Number square inches in Second Group equals 10% of the Sum Total of square inches or 16354.
Comparison of number of square inches in Early and Late group of Biology Text books.
Early Group  Late Group
.8674  .13255

Comparison of total number of square inches in two groups.
41 chapters  45 chapters  10 chapters  182 chapters

Microscopic  Non-Microscopic  Microscopic  Non-Microscopic

Early Group  Late Group

Comparison of Microscopic and Non-Microscopic Subject Matter in each.

book.
Comparison of space devoted to the Biological Subjects in each book.
Comparison of space devoted to the Biological Subjects in each group.
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   School and Society, Mar. 24, 1923.


3. Fuller, Florence D. -- "Scientific Evolution of Text Books".

4. Locy, W. A. -- Growth of Biology, Ch. I.


   Vol. 23, January 1928.
