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ABSTRACT

This project was funded by the National Science Foundation to help institutions of higher education develop course-related library instruction programs for students in undergraduate science programs. The second volume of the annual report for 1976-77 continues appendix four of the first volume, the October 1976 workshop proceedings. It presents ten documents referred to in the proceedings text. These include laboratory exercises, exercises on biological literature, bibliography of general reference sources in biology, objectives for biology instruction, simplified search strategy for undergraduate biology students, library examination instructions and questions, selected pages from the psychology bibliography, and chemistry library assignments. (Author/KP)

VOLUME II

The Development of Course Related Library and Literature Use Instruction in Undergraduate Science Programs

(NSF Grant DSI 76-10129)

Annual Report

June 22, 1976 - July 1, 1977

by

Thomas Kirk

Project Director

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BIBLIOGRAPHIC INSTRUCTION AT EARLHAM

Recently I agreed to interview a few prospective freshmen for the Admissions Office. As a result of that decision I have been led, perhaps earlier than otherwise, to ponder the question: what makes Earlham College better than other places? What does Earlham have that other four-year liberal arts colleges don't have? My answers wandered far afield, from a Quaker tradition to an equestrian program. But in my brief time on this campus, I have come to the view that one of the most important things Earlham has that other institutions lack is Evan Farber. This opinion has been shared so widely and for so long, of course, that is has long since assumed the quality of an objective truth. The existence of this truth was confirmed once again, however, on the last day of January when a group of Farber's friends gathered in Jones House to share their views concerning the nature and future of bibliographical instruction at Earlham. (The depth of their loyalty can be gauged when one reflects that the last day of January was a Saturday!)

During the morning session we pondered the place of bibliographical instruction in a liberal arts education, and quickly (for a newcomer like me) the extent of Evan's influence became apparent. As we began, Len Clark centered our attention upon the essential rather than the ancillary relationship of the library to the classroom. That such an observation was greeted with the respect due an established truth is eloquent testimony to the distance Earlham has come in developing an idea which still falls upon stony soil at most institutions of higher learning.

As if to underline the truth of the observation, Jerry Woolpy summarized his excellent paper describing the development of a collaborative and integrated bibliographical instruction in introductory biology. The general biology course moves beyond the tradition of classical education--classroom, lecture, textbook --with the systematic use of guided library exercises and programmed materials, reinforced by course examinations which require the use of new-found skills of information retrieval. Through these means, the course serves, in Jerry's words, to extend "the boundary conditions of knowledge" of students in a field which, more than most, is characterized by rapidly expanding information and rapidly changing assumptions.

In the course of the discussion which followed, it quickly became apparent that not all of the disciplines represented had been able to develop the relationship between library and classroom to the degree which the biologists had. It was pointed out that some of the assumptions of "essentiality" can be accepted in some fields more readily than in others. Some approaches to knowledge rely upon experiences which can be enhanced only in limited ways by bibliographical instruction. Len Holvik's observation that a student can produce a good formal paper on Beethoven's music based entirely on research in the written word without having heard a note of the Great One's music struck me as illustrative of the problem as perceived by the arts in particular.

As others voiced their own experiences with library instruction, a subtle range of possibilities was revealed. Each of us, I suppose, shared Hal Hanes's experience of "brain-storming" as the words of colleagues sparked renewed speculations concerning his or her own field of teaching. Our discussion of the uses of bibliographical instruction in particular courses served to make us more immediately aware of the view shared by Len Clark and Jerry Woolpy than in our various disciplines we are more concerned to teach different "ways of knowing", different patterns and habits of thought and investigation, than merely different bodies of substantive information. The interdisciplinary exchange was helpful in making us more alert to the another's problems and in making the librarians more aware of the variety of ways in which the disciplines approach the relation of method to substance.

In the afternoon session, the workshop discussed possibilities for encouraging additional use of bibliographical instruction at Earlham. Among the suggestions was a plea for more systematic interaction between teaching faculty and librarians at the planning stage of course development, interaction on a personal, departmental, or divisional level. The preparation of an overall plan for such instruction by the library staff to make systematic what had been episodic was another related suggestion to encourage ways to bring the librarian's tools of access to bear on specific courses and course projects.

The need is clearly for each to educate the other in the possibilities available. The importance of working to this end was demonstrated by the workshop discussion and seems to boil down to this: a working familiarity with the use of the library can serve to achieve one of the most basic purposes of a liberal arts college--it can truly "liberate" the student to be a self-starter. Bibliographical instruction, when it is accomplished in the context of a substantive academic program and is done with practical rather than with mere formal ends in mind, really frees the student by awakening her or him to the possibilities of the scholarly task. The feeling of achievement when one comes across a gem of information obtained only because one knew where to look is in a very real sense its own reward.

Bob Johnstone

(Editor's note: Farber's Friends is an unchartered but actively proselytizing group. The initiation fee is a written or verbal request of an Earlham librarian for help in building library use into any course at Earlham. Membership is lifetime. For further information call on Tom, Jim, Phil, Leo, Hal, or even Evan himself.)

Bob's generous comments and thoughtful evaluations are very much appreciated. But I must note that our accomplishments would have been minimal without the cooperation and support of so many members of the Earlham community, both faculty and administration. I don't know of any other institutions where one would hear teaching faculty talking about "the essential rather than ancillary relationship of the library to the classroom" or about the importance of teaching different "ways of knowing", using bibliographic instruction as one teaching method.

It seems to me the next developments we should look toward are: 1) relating bibliographic instruction to those courses or areas not making adequate use of it now; 2) developing assignments and course objectives that will require students to apply evaluative criteria and critical analyses to the choice of materials in addition to just learning how to find materials and information. What both of these call for, I think, is, as Bob states above, "more systematic interaction between teaching faculty and librarians at the planning stage of course development." There's not much question that the most effective examples of teaching the use of library resources have been those that were built into a course, and I think we've only begun to explore ways of doing this.

The seminar at Jones House was most constructive and gratifying. We'd like to build on it. We will have soon a much more detailed account of its proceedings and are working on a compilation of the various applications of bibliographic instruction in a variety of courses. We'd appreciate comments and suggestions.

Evan Farber

Ecological Biology
Earlham--Fall 1976.

How to Find Information in the Library

Depending on the lab section you are in, you will do this lab work during the third or fourth week of the term:

Instructor	Time and date of library lab		Report to ED lab for library orientation at:	
*Alpha				
Bill Harvey	Wednesday afternoon	Sept. 29	1:00 pm	
Lucky Ward	Wednesday afternoon	Sept. 29	1:00 pm	
Bill Stephenson	Thursday afternoon	Sept. 30	2:00 pm	
Margaret Lechner	Thursday afternoon	Sept. 30	1:00 pm	
*Beta				
Bill Buskirk	Monday afternoon	Oct. 4	1:00 pm	
Dale Hoyt	Monday afternoon	Oct. 4	1:00 pm	
Skip Blanchard	Tuesday afternoon	Oct. 5	1:00 pm	(Dennis 110)
Dale Hoyt	Tuesday afternoon	Oct. 5	1:00 pm	(Dennis 110)
Jerry Woolpy	Tuesday afternoon	Oct. 5	1:00 pm	(Dennis 110)

The week in which you do not have the library lab, you are to come to your lab at the regular time for the start up of the Plant competition experiment.

Before coming to the library exercise lab, please purchase at the Bookstore a copy of the library exercise materials and read the library handbook which is enclosed in the bookstore packet. Don't worry if the bookstore is out of packets, we will have extras in lab. But, do bring the $1.25 to pay for it. Bring these materials to the lab; also bring your copy of your text.

This lab is intended to provide you with some experience and knowledge concerning the use of the library. These library skills are important: 1) immediately, because the demands of the course--laboratory preparation, the library examinations, and just finding information beyond the text and lectures--will require you to use these skills; and 2) in the long run, because these skills make it possible for you to independently locate information for personal edification and interest. The intent of this instruction is to provide you with an introduction to:

1. The physical layout of the Wildman Science Library. You should be able to go quickly to the various areas; bibliography area, reference, card catalog, periodical shelves, book shelves, and microfilm areas.
2. Beginning library search techniques. What literature sources do you consult? In what order do you consult them?
3. The use of the card catalog. Why use a subject heading list? How are tracings useful in the use of the card catalog?
4. The use of the Science Citation Index. How are citations (references) used in indexing?
5. The use of Biological Abstracts. What does it index? When do you use it in a literature search? How do you handle the index?

At the beginning of the lab period, an explanation of the "Guided Exercises" will be given you by Tom Kirk, along with a few other comments on the library.

Assignment due: The response sheets are due by the lab period of the following week. You should turn in your sheets at the circulation desk of the science library. You should also take the brief quiz. The grade information on this quiz will not be given to instructors. You will receive the corrected quiz. We will be happy to discuss the answers with anyone.

*When library exams are assigned later in the term, the 1st (Alpha) group will do their exam first and the 2nd (Beta) group will do theirs second.

GUIDED EXERCISE FOR LOCATING BIOLOGICAL LITERATURE: GENETICS (1977)

Name _____ Date _____

Class: Fr_____ So._____ Jr._____ Sr._____

Time used to complete 1st section; Getting Started: _____hrs.

2nd section; Using the Subject Card Catalog: _____hrs.

3rd section; Reviews: _____hrs.

4th section; Science Citation Index: _____hrs.

5th section; Biological Abstracts: _____hrs.

TOTAL: _____hrs.

Please turn in this exercise and your response sheets by _____ at the Wildman Science Library circulation desk. (This is required for satisfactory completion of the course.)

The following is a guided exercise intended to show you a method of doing library research. When you have finished, you should have acquired an introduction to Earlham's Wildman Science Library and to a search tecnhique which is basic to most library research.

While there is no literature problem in biology that can be considered typical, it is hoped that the problem used here illustrates the major aspects of literature searching teahniques.

In addition to this exercise the envelope should contain a copy of "Reference sources for library research in General Biology."

The problem to be investigated is:

> How is chromosome mapping accomplished? Discuss one method of mapping in detail and include comments on the reasons this method is used; also discuss how extensively the technique is applied in chromosome mapping.

The question is phrased very simply, but often research questions use vocabulary unfamiliar to you, and frequently undefined terms turn up in your reading. In these cases, you should turn to a specialized dictionary, such as the McGraw-Hill Dictionary of the Life Sciences, Sci/Ref/QH/302.5/M3.

Any library researching must be viewed as a linear activity in which the searcher moves from one state of knowledge to a more advanced one. The researcher begins from a general point and works through the search routine, attempting to become more specific and knowledgeable about his topic. This exercise will follow a similar pattern starting with the simple questions of what chromosome mapping is and what techniques are used to do the mapping. (This exercise breaks the linear phenomenon into three sections: 1. Locating the general material in tertiary and secondary sources; 2. Using the citation index method to locate primary and newer secondary sources; 3. Using an abstracting service to survey the literature).

The starting point (point of generality) may be at any level of difficulty. It might be a first grader who wants to know what a chromosome is, a college student beginning in biology who wants to know something about chromosome mapping, or a graduate student who wants to know about relative chromosome location of six characteristics in the T4 bacteriophage (a virus that invades bacteria). In all cases, the person involved will attempt to find information which will develop his understanding and knowledge from the general point of departure to a more specific end.

Section I
Getting Started

The best place to start is your own textbook or an encyclopedia in the library. Note first a textbook. (See Wilson, Life on Earth, on reserve.) Examine its Table of Contents and index. Pinpoint the material on chromosome mapping.

What pages in the textbook provide useful information on chromosome (gene) mapping?

The index under Gene mapping indicates pp. 208-218 are on the techniques and related issues are discussed on pp. 252-261, 225-6, and 227-8.

There is no difficulty in finding the material in this example. There may in other cases by a problem. Therefore, it might be necessary to check the table of contents or to simply browse through the relevant chapters.

Note that at the conclusion of each chapter (e.g., p. 229) are "Readings." Whenever you use a text, be on the lookout for these important sources of additional material.

Before proceeding with the search you should become familiar with three terms which you may not have heard used in relation to library materials. Tertiary, Secondary, and Primary literature refer to three types of literature which have varying degrees of distance from original scientific research.

Primary literature is a report of research written by the research worker. Secondary literature is a review or summary of a number of pieces of primary literature. Therefore, you may have many articles (primary sources) which report on various research projects, and one or a few summaries (secondary sources) which review the primary literature. Tertiary literature is even further removed from the original research, but more importantly it was written for a specific audience or for a specific purpose. The tertiary literature category included textbooks, dictionaries, encyclopedias, and handbooks.

What type of literature source is a textbook?

Tertiary.

Which of the titles listed in the "Readings" section (p. 229) of the textbook does the library have? What are their call numbers?

(Note: The card catalog is divided into two parts. The Author-Title portion is to the left when you enter the library.)

Hayes, W.	*yes:*	*Sci/QR/73/H3/1968*	
Stahl, F. S.	*yes:*	*Sci/QH/431/S8.94*	*(1st ed. only)*
Hartman, P. E.	*yes:*	*Sci/QH/431/H2.97*	
Jacob, F.	*yes:*	*Sci/QR/84/W8.13*	

In the normal course of doing a search, it would now be appropriate to study the relevant sections of these books and, if they provided bibliographies of additional material, to check on them. This series of steps can be repeated as many times as is possible and useful. (You, however, should not do that now but instead continue reading here.) The bibliographies in most sources will include references to a variety of types of literature: tertiary, secondary, primary.

Which of the following sentences best defines a primary literature source?

a) Compilations of data summarizing experimental work described in diverse publications.

b) An encyclopedia, dictionary, or similar type reference book.

c) Accounts of original research, written by the research worker.

Primary sources are (a) accounts of original research written by the research worker.

To summarize briefly the following points should be made:

a) A good place to start library research is with yours or another [redacted] or an encyclopedia in the library.

b) Texts frequently contain bibliographies which are valuable leads to additional material.

c) There are three categories of literature which one finds in the library; tertiary, secondary, primary. The ability to distinguish between them and understand the relationship among them is useful.

Another way to identify useful secondary and tertiary sources is through the McGraw-Hill Encyclopedia of Science and Technology. Read its annotation in the other mimeographed handout entitled, "Reference sources for library research in General Biology."

Using the index to the encyclopedia, locate the sections that might be useful for our topic, chromosome mapping. List the volume numbers and pages where this information can be found.

From the index several potentially useful sections can be readily identified:

Chromosome 1:759; 2:612, 613, 635, 638; 3:115-119*; 11:403-404.
Mapping human genes 6:574-575

Note that the vol. 3 item is starred. This is an indication that the most complete coverage of the topic, "Chromosome" is located there.

Upon inspection of the articles in volumes 1, 2, 3, and 11, we find that these really aren't good ones on the topic of chromosome mapping, and 6:574-575 is only on human gene maps.

Whenever you use an index, do not be satisfied to look up only one term. Frequently there are related terms, and synonyms which will also lead to useful information. What other terms might be checked? Refer to the original problem on page 1 to refresh your memory.

Genes and Maps or Mapping are possibilities.

Check these terms in the index for possible articles. To what volumes and pages are you directed?

Gene 2:613; 6:108-109
Genetic mapping 6:119A-120
Map
genetic 11:[illegible]90-101
Mapping
genetic 6:119A-120; 120C-120D, 574

Note the number of subdivisions under "Chromosome" and "Gene." By using such subdivisions it is frequently possible to pinpoint the information needed.

Scan quickly the Genetic mapping article on pages 119A-120, vol. 6. Note the number of SEE references. These can be very useful in fitting together all the information on a broad subject or in locating more specific material.

After reading the information provided by the encyclopedia, one should use the bibliography associated with the useful article(s). List those books in the Genetic mapping article which could be checked for further information. (Please note that most of the references are to journal articles, or articles from serials. If you are not sure how you would tell the difference study the examples below.)

Book: Smith, John David. Life of the Mouse, 2nd ed., 1970.

Journal or serial article:
(1) Smith, John David. Journal of Biology 45:345-356 (1970)
(2) Smith, John David. Life of the Mouse. Journal of Biology 45:345-356 (1970)
(3) Smith, John David. Progress in Biology, vol. 15 (1973)

List those books in the Genetic mapping article which could be checked for further information.

A. Kornberg, DNA Synthesis, 1974.
J. Tooze, The Molecular Biology of Tumor Viruses, 1973.
J. D. Watson, Molecular Biology of the Gene, 2nd ed., 1970.

All the other references given are to journal articles or serials.

Which of these three books does the library have? (The author-title catalog is near the main entrance to the library and is where you should look to see which of these the library has.)

The library has the Tooze and Watson books.

This exercise has now completed an illustration of the methods used in locating general sources, and bibliographic references to other tertiary and secondary sources which they provide. These methods have all involved the use of literature references which some author has suggested are related to what he has been writing about. The card catalog so far has been used only as a locating device. The exercise will now take up the card catalog as a subject index.

Section II
Using the Subject Card Catalog
Library Catalogs and Their Arrangements

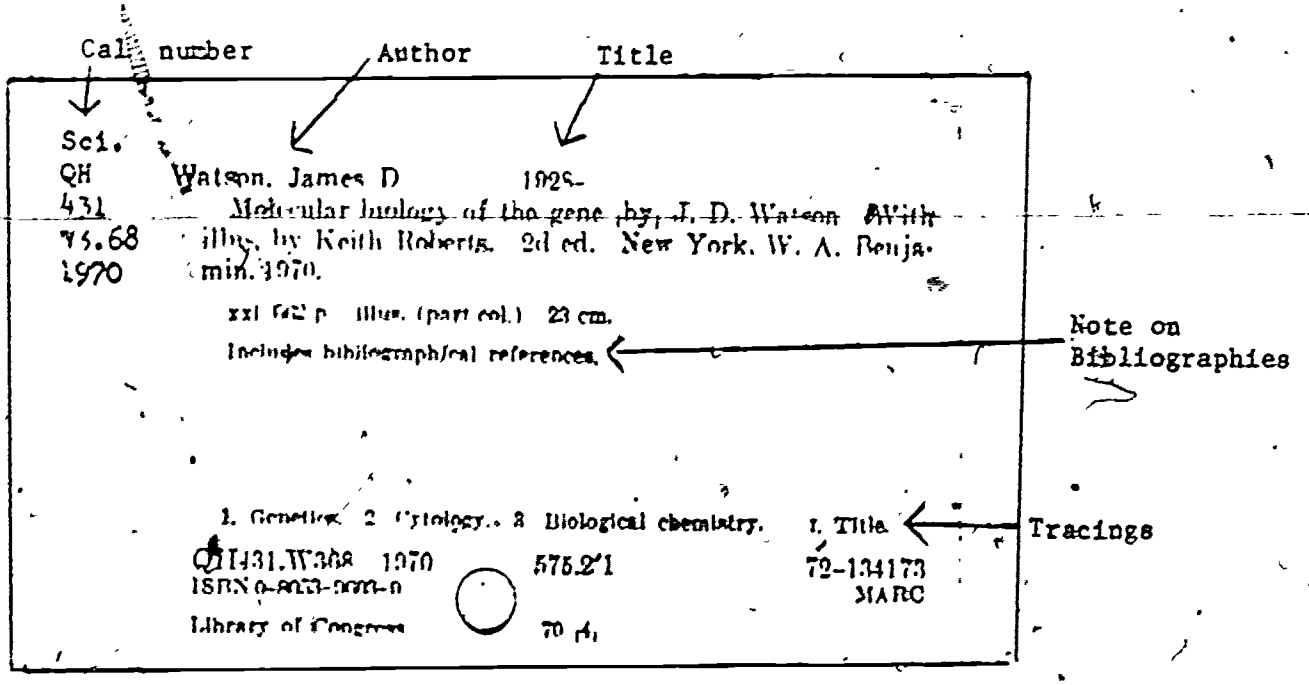
As each volume is added to the library, it is according to its subject, allocated an appropriate classification symbol; this symbol in the Earlham libraries is a combination of both letters and numbers, and it is printed on the spine of the book. The books are then arranged in order by the classification symbols. Storage in a library is for the sake of retrieval and browsing. Part of the librarian's job is the accumulation of appropriate materials, but the more important aspect is the accessibility of those materials. This means arranging the material logically and systematically and providing the necessary key to the arrangement. The easy retrieval of books depends on the catalog, which is an index to the collection. It is advisable to use the catalog rather than go directly to the shelves, since the catalog represents the entire collection, whereas the books found on the shelves at any given moment represent only a portion of the collection.

The catalog tells what publications are available 1) by a given author, and 2) on a given subject. The Author-Title Catalog entries consist of 1) the main entry for each book, under the name of the author; 2) added entries under subsidiary authors, editors, translators; 3) entries under the name of important sets or series of works; and 4) entries under the title. It is important to remember that the name under which a publication is entered may not be a personal one, but the name of a corporate body which is in certain cases treated as the author. Such a corporate body may be a government department, a learned society, an academic institution, or an international conference.

Each card gives the classification symbol of the publication, so that the inquirer will be directed to the correct place on the shelves.

Earlham has divided its catalog into two parts: Subject and Author-Title, and each catalog follows an alphabetical arrangement. Our system of subject headings uses the Library of Congress subject headings. An elaborate system of cross-references is essential, since references to related subjects are inevitably scattered.

Although the main book collection is normally arranged in sequence by call number , it is well to realize that the sequence may be broken or changed to suit the particular needs of individual libraries. We have blocks that tell where the materials are located if they are out of sequence. No matter what the situation, the librarians are glad to help any person in the search for appropriate information; indeed; this is their primary task.



Tracings are the list of headings under which the book is listed in the card catalog. They are found at the bottom of each card for the book. Those listed after Arabic numerals are to be found in the subject catalog. Those listed after Roman numerals are given in the author-title catalog.

What is the subject heading assigned to the book by Watson?

"Genetics."

This simple procedure of identifying the subject heading(s) assigned to a book which you already know about has great searching potential. For now it is possible to check this subject heading in the card catalog for additional material.

Does the library have any other books which have had the same subject heading, "Genetics," applied to them? Which of these books that were not located earlier appear to be of potential use for study of the topic of chromosome mapping? (To be useful they should be fairly recent publications, last three to five years; be of substantial size, 200 or more pages; have bibliographies.) List only the few best. (Use only the card catalog. It is not necessary to go to the shelves.)

* Advances in Genetics, Sci/QH/431/A1/A3.
Anfinsen--Not relevant
Auerback--Not relevant
Bateson--Too old
Beadle--Too general
* Bodmeer, W. F., Genetics, Evolution, and Man, Sci/QH/430/B8.4.
Boyd--Not relevant
Braun--Too old
Brewbaker--Not relevant
British Museum--Not relevant
Butler--Too general
Caspari, E. W., Genetic Organization, Sci/QH/431/C2.58. (Getting dated,
Catcheside--Too old
Crew--Too old
Daubins, R., The Selfish Gene. -?? What is it about?
Dobzhansky--Too old
Durh--Not relevant
Ehrlich--Not relevant
Ephrussi--Not relevant
Falconer, D. S.--Too old
Fincham, J. R. S. --Too old
Ford--Not relevant
Goldschmidt--Too old
Gottlieb--Not relevant
Grant--Not relevant
Hayes--Not relevant
Herskowitz--Too general
Huxley--Not relevant
Kempthorne--Not relevant
King--Not relevant
Lerner--Not relevant
* Levine, L., Biology of the Gene, Sci/QH/431/L4.175
* Lewis, K. R., The Organization of Heredity, Sci/QH/431/L4.185/1970.
Li--Not relevant
Moore--Not relevant
Muller--Can't tell
Pfeiffer--Too old
* Pontecorvo, G., Trends in Genetic Analysis, Sci/QH/431/P7.54. --While old and short it is specifically on our topic. This is a warning that reading files such as the card catalog is not routine. Often you must go against all of the more obvious signals (age, size, etc.).
Ravin--Not relevant
Roberts--Not relevant
Sheppard--Not relevant
Sinnott--Too old, too general
Srb--Too general
Stahl--Too old
Stebbins--Not relevant
Sturtevant--Too general
Swanson--Not relevant
Symposium--Not relevant
Texas--Not relevant
U. S. Brookhaven, Structure and Function of Genetic Elements, Sci/QH/431/U5--Too old.
U. S. National Laboratory--Not relevant
Wallace--Not relevant
Watson, J. D., Molecular Biology of the Gene, Sci/QH/431/W3.68/1970--already have.
* Whitehouse, J. L. K., Towards an Understanding of the Mechanism of Heredity, 3rd ed., Sci/QH/430/W4.7/1973.
Wollman--Not relevant

If there is any confusion about what is meant by "Genetics," "Genetics - Addresses, essays, lectures," and "Genetics - History," you need not be concerned yet. Subdivisions will be explained shortly.

These books would ordinarily now be checked for usefulness and any additional bibliographic leads. It is not necessary to do that here. Instead, the exercise will continue the study of techniques for using the card catalog effectively.

Note the last card in the catalog under the heading "Genetic psychology." This type of card is placed throughout the catalog and is important in referring users to the Lilly Library when necessary. They are not used unless there definitely are books in the Lilly Library that have had the particular heading applied to them.

The preceding method of tracing books will not work if the library does not have the books listed in bibliographies such as those in your text, or the encyclopedia. If this happens, it is necessary to identify your own subject headings. Because the headings chosen by library patrons are frequently incomplete and improperly phrased (from the indexer's point of view), and because there are frequently related or synonymous terms one overlooks, you should use a list of search terms to identify search terms for your search in the card catalog.

The eighth edition of the Library of Congress list of search terms is such a source, and contains the headings established and applied by the Library through December, 1973. Subsequent additions to and changes in these headings will be found in the Supplements.

On the next page are some examples from the Library of Congress list of search terms. These examples are not related to the genetics topic of the exercise because they were chosen to exemplify the major points with which you should be familiar. You should study the page carefully to make sure you understand what each of the following are and what they mean: main heading, see also references (sa, xx), see references (x), and subheadings. After you have carefully studied the page, continue on to the next page where you will find a few questions which will test whether you understand these terms. Then the exercise will give you an opportunity to find material through the catalog on your topic.

Botany (Indirect) (QK) ← MAIN HEADING

sa Acclimation (Plants)
Woody plants

Also divisions, classes, etc. of the vegetable kingdom, e.g. Algae, . . .

SEE ALSO HEADINGS
(These related headings are of a more specific nature. They should be consulted for more specific material.)

x Botany--Phytography
Vegetable kingdom

HEADINGS NOT USED IN THE CARD CATALOG

--Analysis blanks (QK 57)
--Anatomy (QK 641-707)

sa Abnormalities (Plants)

SUBHEADINGS
(These are subdivisions of the main heading: Botany.)

--Histology ← SUBHEADING
(But one which is not used since SEE REFERENCES follow it.)

See Botany--Anatomy ← SEE REFERENCES
Plant cells and tissues

Meristem (QK 725) ← MAIN HEADING

sa Growth (Plants)
Roots (Botany--Anatomy)
xx Growth (Plants)
Plant cells and tissues

Plant cells and tissues (QK 725) ← MAIN HEADING

sa Chromatophores
Meristem
Phloem
Plant cell walls
Raphides
Rejuvenescence (Botany)

SEE ALSO HEADINGS

x Botany--Histology
Tissues, Vegetable

HEADINGS NOT USED

xx Botany--Anatomy
Cells
Cytology

SEE ALSO HEADINGS
(These are different from the sa headings in that they are more general. These should be used when the main heading (Plant cells . . .) is not listed in the card catalog.)

SAMPLE ENTRIES FROM THE LIBRARY OF CONGRESS LIST OF SUBJECT HEADINGS

Below is a copy of several entries from the search terms list. Match the numbered items with the lettered statements below.

Botany--Histology
See Plant cells and tissues 1.___

Plant cells and tissues 2.___

sa Meristem 3.___

x Botany--Histology 4.___

xx Botany--Anatomy 5.___

-- Bibliography 6.___

A. Not any of those listed below.

B. A related heading that has also been used. It should be checked for additional material.

C. Main heading.

D. Subheading under Plant cells and tissues.

E. A broader heading than Plant cells and tissues. It should be checked if the card catalog contains nothing under Plant cells and tissues.

F. Cross reference from a possible heading to the actual heading.

1. F 2. C 3. B 4. A 5. E 6. D

Two other aspects of the subject heading list should be noted:

Class Numbers. (Call numbers)

Many of the subject headings are followed by Library of Congress class numbers which generally represent the most common aspect of a subject (e.g. Meristem (QK 725)). If several aspects of a subject are covered by different class numbers, the latter are qualified by a term indicating the specific discipline to show the distinction; e.g., Shellfish (Cookery, TX 75; Public health, RA 602.S2; Shellfish as food, TX 317; Zoology, QL 401-445).

If your subject heading happens to have a class number after it, one can avoid the card catalog entirely and go directly to the shelves and browse.

Form Headings.

Many headings may be divided by several kinds of subdivisions (e.g., on page 16 of the exercise "--Anatomy" under "Botany"). Those found appropriate to a main heading are listed under that heading, following the cross references. Subdivisions of general application are listed below. They may be used under any heading.

Abstracts

Addresses, essays, lectures
For addresses, essays, or lectures, whether issued singly and dealing with the subject as a whole or in general terms, or in collections by one or more authors dealing with various aspects or branches of a subject.

Bibliography

Case studies

Collected works
Ordinarily for works of one author. In certain cases, especially under scientific and technical headings, the subdivision Collected works is used for works by one or more authors, e.g., Science-Collected works.

Collections
Ordinarily for publications containing works by different authors. In certain cases, however, especially under scientific and technical headings, the subdivision Collected works is used for collections of works by either one or several authors in order to avoid suggesting a work on collections of objects.

Congresses

Dictionaries

Directories

Exhibitions

Film catalogs

Handbooks, manuals, etc.

History
For all works except those dealing with literature and music; for which History and criticism is used.

Outlines, syllabi, etc.
Periodicals
Societies, etc.
Statistics
Study and Teaching
Yearbooks

Before actually using the Library of Congress Subject Headings book, an analysis of the topic should be undertaken. Combining the general knowledge gained from reading the textbook, the McGraw-Hill Encyclopedia article and other sources, one finds the following area to be of interest: Mapping of chromosomes of fungi using mitotic recombination. The key words or subjects contained in this capsule statement are:

mapping
chromosome
chromosome mapping (reading reveals gene mapping is used synonymously.)
fungi
Aspergillus (fungal organism most frequently used in mitotic recombination work.)
yeast

Check the key word "Chromosome Mapping" in the LC Subject Headings to find what the search term is and if there are any related terms that might be useful. What is the proper search term? Are there any related terms that might be useful? Remember, you are trying to match your key word with a list of search terms which may not contain exactly the right heading. It may therefore be necessary to scan the list in the area of chromosomal . . . chromosome . . . chromosomes.

Chromosome mapping

Chromosomes (QH 605)

sa Allelomorphism

Crossing over (Genetics)

Linkage (Genetics)

xx Heredity

"Chromosome mapping" is the proper search term which is closest to the topic desired. Related terms are "Linkage (Genetics)," and the more general term "Chromosomes".

Check under the search terms "Chromosomes", "Chromosome Mapping" and "Linkage (Genetics)" in the subject card catalog and list the useful titles.

Chromosome mapping - None

Chromosomes:

White, Michael James Denham, The Chromosomes, Sci-QH/600/W4.6/1973

Linkage - None

What are the actual search terms for the key words mitotic recombination, fungi, yeast?

The correct form of the key words is:

mitotic recombination: "Mitosis" or "Cell division (Biology)"
fungi: "Fungi", "Fungal genetics"
yeast: "Yeast"

If these search terms were checked in the Subject Catalog the following useful titles would be found:

Cell division (Biology)-nothing useful
Fungi
Ainsworth, G.C., The Fungi, Sci/QK/603/A5.2
Roper, J.R., Genetics of Sexuality in Higher Fungi, Sci/QK/601/R3
Yeast
Recent Trends in Yeast Research, Sci/QR/151/R4

The development of a list of search terms may seem to have been belabored in this instance and perhaps it was. The most important secondary sources Pontecorvo's Trends in Genetic Analysis and Watson, Molecular Biology of the Gene were found very early in our search. This is frequently not true, therefore, this exercise has attempted to show what you should do when you are attempting to find a good survey of the topic which you wish to study.

The list of books we have developed provides a substantial list of tertiary and secondary sources useful to this topic. Normally the next step is to sift through the material you have collected and to pick out the important information and bibliographic sources that lead to additional information.

When you have finished evaluating all the material so far gathered, you will have a good basic understanding of the topic and can then proceed to fill in the gaps or to follow up some specialized aspect of the topic. You are not actually to do this as part of this exercise. In your actual searches some of the above steps may prove fruitless. Do not get discouraged. In each library research project you are bound to meet blind alleys. The library user is urged to be patient and methodical in doing a search. Whenever the system proves unusable, ask for help from the reference librarian. He is an expert in how the system operates and this is best qualified to guide you through the maze.

Section 3
Reviews

Since textbooks, and other monographs take two and sometimes three years to get published, the references included in their bibliographies are usually several years old. Furthermore, the treatment of the subject in the text will not take into account recent research. It is therefore necessary for you to find ways to get into the more current research literature. One of these ways which use indexes to the research literature will be discussed in Sections 4 and 5. However, those indexes will be easier to use if you first have some knowledge of the research literature of the last few years--the literature which is not covered by the texts and monographs you have located in Sections 1 and 2 of this exercise.

In order to close the gap between the older text materials and the most recent research listed in indexes and abstracting tools, it is necessary and useful to read articles from review serials.* These publications are usually published quarterly, semi-annually, annually, or biannually. Each issue of these serials consists of several articles which review the recent research on a specific topic. To do the review, the author has compiled a selected bibliography, sometimes reaching 400 citations in length, of recent research articles on the topic. The author then summarizes the direction of the research; the problems explored, the issues resolved, and those unresolved. Often these articles are critical and are usually particularly good at stating where the field is in its development. It is this last characteristic which is responsible for the often used description, "state-of-the-art" reviews.

Because the review serials cover broad topics or subjects, you usually will not be aware of them during the early stages (Sections 1 and 2) of your library search. Furthermore, they are scattered about the library depending on whether they are periodicals or annuals. We therefore have made a list of the most important review serials and included it in your "Bibliography of General Reference Sources for Ecological Biology".

Check pages 10 through 13 of your bibliography and list the review serials which cover general fields of which your topic is a part.

*Serials are any continuing publication, published under one distinctive title. Such things as newspapers, magazines (=periodicals, = journals) annual reports, irregular bulletins, etc, are all serials. Magazines, also called periodicals or journals, are serials but of a special type. They are serials issued at regular intervals, at least twice a year.

The review serials that may contain articles on the topic of mitotic recombination as a method for chromosome mapping in fungi:

American Scientist. Periodical.
Quarterly Review of Biology. Periodical.
Advances in Genetics. Sci/QH/431/A1/A3.
Annual review of Genetics. Sci/QH/431/A1/A5.4.
Scientific American. Periodical.

Remember that the scope of there serials may be quite broad, but the individual articles will be specific and cover only a very limited topic.

The review series are not shelved together. Your bibliography will indicate the location: Periodical means it is in the bound periodical and/or microfilm collection (see floor plan for location); Sci/ followed by a call number means it is in the regular collection (see floor plan for location). Note the arrangement of the volumes.

Do they all have individual volume subject indexes?

Yes, they all have individual volume indexes.

Which ones have cumulative subject indexes?

American Scientist has an index covering the period 1946-1973.
Advances in Genetics has an index for volumes 1-16 (1948-1971) in volume 16.
Scientific American has an index covering 1948-1971.
Annual Review of Genetics has a classified list of titles for the last five years in each volume, but these should not be relied on as detailed subject indexes.

Check Advances in Genetics (Sci/QH/431/A1/A3) and the Annual Review of Genetics (Sci/QH/431/A1/A5.4) for the years since the writing of the most recent secondary source on your topic. (In this case the most recent useful source you have so far come across is Pontecorvo's Trends in Genetic Analysis, published in 1958. Remember we said that it takes several years to get a book published, therefore it would be a good idea to check the review serials from 1956 to the present.)

Are there any useful reviews, or parts of reviews on the topic chromosome mapping in fungi using genetic recombination in any of the two serials listed above? List the useful articles.

Advances in Genetics (Sci/QH/431/A1/A3) volume 6 has an article on mapping, but in Neurospora, not Aspergillus, but volume 9 has an article by Etta Kafer on "An 8-Chromosome Map of Aspergillus nidulans." You may also have found an article by G. Pontecorvo, also in volume 9. This article is extremely useful, however, you likely did not find it in the cumulative index because the index is based only on the terms in the titles of the articles which in this case are not the ones under which you would look. This is a technique of indexing, key word indexing, about which you will learn more later.

Annual Review of Genetics (Sci/QH/431/A1/A5.4), the 1975 and 1971 volumes have material on human chromosome mapping (pp. 81-120), the 1970 volume has an article on fungal genetics that briefly discusses gene mapping (p. 383), the 1969 volume has information on chromosome mapping in wheat (pp. 462-463), and the 1967 volume has another article of fungal genetics which contains information on recombination in Aspergillus (pp. 215), but none of these articles specifically covers mapping in Aspergillus using recombination.

In a normal search these reviews should now be carefully surveyed for useful information and citations to add to a growing bibliography of periodical articles on your topic.

In concluding Sections 1, 2, and 3, the following points need to be made:

1. The objective of the search to this point has been to get background information, and the identification of the one or two most up-to-date articles or books that review all the important subject material related to your topic. If this is accomplished, you will save yourself a tremendous amount of time and work. In the case of this topic, Pontecorvo's book (p. 14) and article (p. 28), and Kafer's article (p. 28) are the best available. With these reviews, it is unnecessary except for elaboration on a given point, to go back in time in any further literature search beyond 1958. Thus you can concentrate your searching to the years 1959 to date.

2. These sections have illustrated the use of the McGraw-Hill Encyclopedia, the use of the card catalog as a locating tool, the identification of search terms for a search of the subject card catalog, and the use of annual reviews. The search for basic summaries on the topic chromosome mapping is completed. The rest of the exercise deals with up-dating and narrowing the topic.

Section IV
Using a Citation Index

Secondary and tertiary sources review literature only to a specific date, just prior to its date of publication. When doing research it is important to up-date the literature found from the time of publication of the review to the present. Not only will this up-date existing knowledge, but also it will indicate new research and new controversies over old interpretations of experimental data. Furthermore it will help to narrow the topic. It is impossible for you to deal with the subject in an encyclopedia fashion as Pontecorvo or Kafer, for example. You must choose a specific topic and focus on the primary literature which discusses it in detail. The quickest way to find new information on an idea in an article is to use a citation index. In the sciences the Science Citation Index (S.C.I.) indexes the major periodicals of biology, medicine, physics, chemistry, psychology, geology, mathematics, and technology.

Two of the best summaries on the topic of mitotic recombination as a method for chromosome mapping in fungi are G. Pontecorvo's "Genetic Analysis Based on Mitotic Recombination," Advances in Genetics 9: 71-104, and Etta Kafer's "An 8-Chromosome Map of Aspergillus nidulans," Advances in Genetics 9: 105-145, Sci/QH/431/A1/A3/1958. Using Pontecorvo (pp. 71-73) and Kafer (pp. 105-6) and their bibliographies, develop a bibliography exclusively and specifically on the topic of fungal chromosome mapping by mitotic recombination. To do this, one must read carefully the pages that pertain and select those sections, paragraphs, or even just sentences that are related to the topic. Then note the bibliographic references that are cited with important sections. For example, the paragraphs below are part of Kafer's "An 8-Chromosome Map of Aspergillus nidulans." Careful reading of the paragraphs tells you that Roper, 1952, would discuss mitotic segregation in Aspergillus. By checking the bibliography at the end of the article, the item can be identified and sought out. The objective in reading the review is to carefully select only the most relevant useful articles.

Kafer, "An 8-Chromosome Map of Aspergillus nidulans," Advances in Genetics 9: 105-145. New York, Academic Press, 1958.

I. Introduction

In species with a sexual cycle, location of markers and establishment of linkage groups is carried out by means of meiotic analysis. Meiotic mapping is laborious, however, when a species has a large number of chromosomes or when, as in *Aspergillus nidulans*, most chromosomes have long maps. This is especially true at the beginning of the analysis. In the first crosses of *A. nidulans*, for example, about 20 markers were used but only 2 small linkage groups were found (Pontecorvo, 1953).

Mitotic segregation in diploids of *Aspergillus nidulans* (Roper, 1952) offers the possibility of mapping by means of mitotic recombination. Two processes of mitotic segregation have been found (Pontecorvo *et al.*, 1951): mitotic crossing-over, as analyzed by Stern (1936) in *Drosophila*, and "haploidization," a process of somatic reduction. In asexual species of filamentous fungi mitotic mapping is the only method available (Pontecorvo 1954, 1956), but even in species with a sexual cycle mitotic analysis may facilitate mapping.

Complete the reading of this section of Kafer (pp. 105-106) and Pontecorvo (pp. 71-73) and critically select any other useful references. What are they? Remember what the specific topic is. (Because, no doubt, several people will want the book at one time, copies of the relevant sections and its bibliography are on reserve.

Your list should include some of the following:

From Kafer:

Roper, J. A., 1952. Experientia 8: 14-18.
Pontecorvo, G., 1954. Caryologia Suppl, 6: 192-200.

From Pontecorvo:

Roper, J. A., 1952. Experientia 8: 14-18.
Pontecorvo, G., 1954. Caryologia Suppl. 6: 192-200.
Kafer, E., 1958. Advances in Genetics 9: 105-145.

The others either do not cover Aspergillus or are made obsolete by this article.

Using the Serials* Drawers in the upper right portion of the Author-Title Catalog, check to see if the library has any of these.

Which of these does the library have?

*Serials are any continuing publication, published under one distinctive title. Such things as newspapers, mazagines (=periodicals, = journals), annual reports, irregular bulletins, etc., are all serials. Magazines, also called periodicals or journals, are serials but of a special type. They are serials issued at least twice a year.

Roper. No.

Pontecorvo. No.

Kafer. Yes. You should recognize that this is the other article you are reading.

Read the following paragraph, then look carefully at pages 33 and 34.

The following is adapted from Bottle, R. T., The Use of Biological Literature, Archon Books, 1967. A citation index is defined as a compilation of cited references under each of which there is a list of the documents where it appeared. The Science Citation Index has listed all the references (citations) from all the articles published in a given year in the most important journals which cover the whole field of science. These are listed in an alphabetical sequence by the first author's name; where several papers by the same author were cited, these are listed in chronological order. Under each citation there are listed alphabetically by (first) author the articles that cited the reference, together with bibliographic details of the articles.

SCIENCE CITATION INDEX (SCI)

(How to use it)

Starting point for searches in the SCI is a specific work. For example suppose you are interested in the subject of Urey's article: "Lifelike forms in meteorites."

Lifelike Forms in Meteorites

Are fossils present in carbonaceous meteorites? The evidence is suggestive but as yet inconclusive.

Harold C. Urey

At a meeting held 1 May 1962 at the New York Academy of Sciences, a group of [illegible] was presented dealing

than the 1700 particles per milligram claimed by the Fordham group [illegible] contradiction to report

mentioning my early skepticism in gard to the whole matter and my gestion that additional experiment hydrocarbons extracted from meteorites be made by spectrosc methods, to supplement the mass trographic analyses. In New Yor October 1961, Nagy had shown chemical and mineralogical data p ing to the possibility that there been life processes on the mete parent body (indications of liquid

H C Urey, Science 137, 623-628 (1962)

In the SCI, this subject is identified by the specific citation:

UREY HC-----62-SCIENCE----- 137 623

Beneath this specific citation is the list of citations for the latest papers on this topic-published in the particular annual or quarterly period indexed. Below is a selection from the 1965 SCI showing the list of citations citing Urey. (NOTE: Urey has written more than one article which were cited in 1965. Each new article is represented by a series of dashes rather than a repition of his name.)

UREY HC	*59*J GEOPHYS RES		64	1721
ANDERS E	SPACE SCI R	R 64	3	583
	60-ENDEAVOUR		19	74
FORD BJ	SPACEFLIGHT	65	7	13
	62-SCIENCE		137	623
MUELLER G	NATURE	L 65	205	1200
	63-NATURE		197	228
ARNOLD JR	ASTROPHYS J	65	141	1348

The R indicates that Anders' article is a Review. For other letters see inside front cover of any SCI issue.

To find the full title, coauthors and bibliographic data for the citing work look in the Source Index under the author's name:

MUELLER FH MUELL CO
3168280 US (a patent) 65 P 1R FEB 2

MUELLER G CLAUS G SUBAC EA
NATURE 205 1200 65 L 10R N4977 62558
INTERPRETATION OF MICRO-STRUCTURES IN CARBONACEOUS METEORITES

Normally you would check any of the important references on your topic that you identified in the secondary sources in all years of S.C.I., from the time the referenced article was published up to the present. However, to make the exercise less tedious and lengthy, you are asked to check only one year.

Using the article listed below and following the steps illustrated on pages 33 and 34, establish which article cited it. Write down only the last two articles listed.

Kafer, E., 1958. Advances in Genetics 9: 105-145. check in 1967 S.C.I.

Dorn, G.L.	*Genetics*	*67*	*56*	*619*
Lhoas, P.	*Genet Res*	*67*	*10*	*45*

With the 1970 volume, the format of the Science Citation Index was changed. Below are the examples of the two formats.

OLD FORMAT

JONES EA	65-SCIENCE			158	1543
BROWN LE	J ECON ENT	67		42	391
HALL BF	J MAMMAL	67		28	42
	66-J EXP ZOOL			49	120
SMALL LG	J ECON ENT	67		42	461

NEW FORMAT

JONES EA					
65 SCIENCE	158	1543			
BROWN LE	J ECON ENT		42	391	67
HALL BF	J MAMMAL		28	42	67
66 J EXP ZOOL	49	120			
SMALL LG	J ECON ENT		42	461	67

Look up this same Kafer article in the 1974 volume of Science Citation Index. Who has cited her 1958 Advances in Genetics article?

Upshall A *GENETICS* *76* *19* *74*

(You may wonder why this is listed, since the Kafer citation above it is to vol. 8, page 101 and not page 105. We must assume that the person citing Kafer, Upshall, made a mistake in his bibliography. Errors of this nature are not caught by the publishers of S.C.I.)

Kessin RH *J-BACT* *119* *776* *74*
Ma GCL *GENETICS* *77* *11* *74*

Science Citation Index is published quarterly. To bring your bibliography even more up-to-date, check the first quarterly issue of the current year.

Has Kafer's 1958 article been cited? By how many authors?

There is 1 reference listed in the first quarter of the 1977 index.

Below is a list of articles found in Science Citation Index, 1967, which cited Kafer's 1958 article. Using the "Source Index," find the titles of the following articles:

In the 1967 Source Index:

Born GL	GENETICS	67	56	619
Lhoas P	GENET RES	67	10	45

In the 1967 Source Index:

Dorn, GL, "A revised map of 8 linkage groups of Aspergillus nidulans."
Lhoas, P; "Genetic analysis by means of parasexual cycle in Aspergillus niger."

Like the "Citation Index" the "Source Index" also changed format in 1970. Below is an entry from the "Source Index" in each format.

OLD FORMAT

STEER RP KNIGHT AR
CAN J CHEM 46 2878 68 N 6R N17 89074
REACTIONS OF HOT HYDROGEN ATOMS IN MERCAPTAN ETHYLENE SYSTEMS

NEW FORMAT

STEER RP
KNIGHT AR-REACTIONS OF HOT HYDROGEN ATOMS IN MERCAPTANETHYLENE SYSTEMS.
CAN J CHEM 46 2878 68 N 6R N17

Now identify the title of the following 1974 article which citer Kafer.

Ma GCL GENETICS 77 11 74

Genetic-analysis of reciprocal translocation T2 (I-VIII) of Aspergillus using technique of mitotic mapping in homozygous translocation diploids.

Does the library have the journals in which these three articles were published? (Dorn, 1967, Genetics 56: 619; Lhoas, 1967, Genet Res 10: 45; Ma, 1974, Genetics 77:11.)

Dorn: yes
Lhoas: no
Ma: yes

They were found by checking the "Serials" drawers of the card catalog.

The use of the Science Citation Index can be very frustrating because it locates too many unrelated articles, or too many that Earlham does not have. However, it is a very simple system which requires little subject background and can be accomplished in a short amount of time. In addition, it is the only system that goes forward in time. That is, it is the only method that permits you to start with an older article and come forward toward the present.

Section V
The Use of Biological Abstracts

Abstracts are summaries of publications or articles along with complete bibliographic information. Biological Abstracts (B.A.) is an abstracting and indexing service which surveys the world's scientific literature in biology and related fields. It is a massive item covering some 130,000 bibliographic items (periodical articles, review articles, symposium papers, and books) each year. The abstracts are numbered consecutively from the beginning of each volume. The abstracts in each issue are arranged under broad subject headings.

Biological Abstracts is used primarily in research where the latest information is necessary. It may also be used for collecting a bibliography for a review of a subject. You might think that the use of Science Citation Index (S.C.I.) provides a complete index for new material, and that B.A. will duplicate. Experience shows, however, that this is not the case. One investigation on the topic of endoplasmic reticulum found 92 articles using both systems. Only one title was found in both B.A. and S.C.I.

Effective use of Biological Abstracts requires considerable experience and a thorough knowledge of the subject being studied. The remainder of the exercise will attempt to show you the art of using the key word index of Biological Abstracts.

Biological Abstracts issues consist of a series of abstracts (see example 1 below) and five indexes. When the issues are bound the indexes are removed from the individual issues and saved until the publisher issues the cumulative indexes. Two of the indexes will be the most useful to you. One is simply an author index (see example 2 below), the other is the B.A.S.I.C., or Biological Abstracts Subjects In Context (see example 3 below).

BIOLOGICAL ABSTRACTS

ments at the start of the underwater period showed a decrease in maximal inspiratory and expiratory flow rates and an increase in pulmonary resistance during tidal breathing compatible with the increased gas density. During the 2 mo. underwater period, a statistically significant increase occurred in vital capacity; in addition maximal midinspiratory flow rate and maximal voluntary ventilation showed an upward trend in two subjects. Postexposure measurements of lung volumes, lung mechanical properties, and diffusing capacity indicated that neither deleterious effects nor adaptive changes in the lungs occurred from the chronic exposure involved in this study. However, the results do suggest that increased strength of the respiratory muscles developed during the underwater period secondary to exercise and physical training.

† 35389. HANSON, PETER G. (Aeromed. Res. Lab., Holloman Air Force Base, New Mex., USA.) Pressure dynamics in thoracic aorta during linear deceleration. J APPL PHYSIOL 28(1): 23-27, 1970.--Abrupt deceleration in the long axis of the body (G_z) may produce traumatic rupture of the aortic arch and descending thoracic aorta. The relationship between thoracic aorta transmural pressure and rupture of the thoracic arterial vasculature was examined during a series of controlled decelerations. Anesthetized beagle dogs were restrained in form-fitted couches and exposed to head first impact ($-G_z$) over a range of 5-60 g. Thoracic aorta and intrapleural pressures were measured by chronically implanted strain-gauge pressure transducers. At impact there was a prominent, short-duration pressure spike in the aortic pressure wave. The magnitude of the pressure peak increased as a linear function of peak g force. Intrapleural pressure also increased as a function of g force. The resulting transmural pressure exhibited an oscillatory fluctuation over the period of impact such that an initial rise in transmural pressure was immediately followed by a rapid diminution. During $-G_z$ impact the transient increase in aortic pressure is compensated by a subsequent rise in intrapleural pressure. Vascular ruptures which occurred in these studies were probably due to violent inertial displacement of the cardiac mass and thoracic viscera.

Example 1: abstracts.

Here we see the end of one abstract and the beginning of another. Note the new abstract begins with a number. This is the "address" for the abstract and is used in the indexes to refer to the particular abstract. Also note the arrangement of the parts of the abstract.

Example 2: author index.

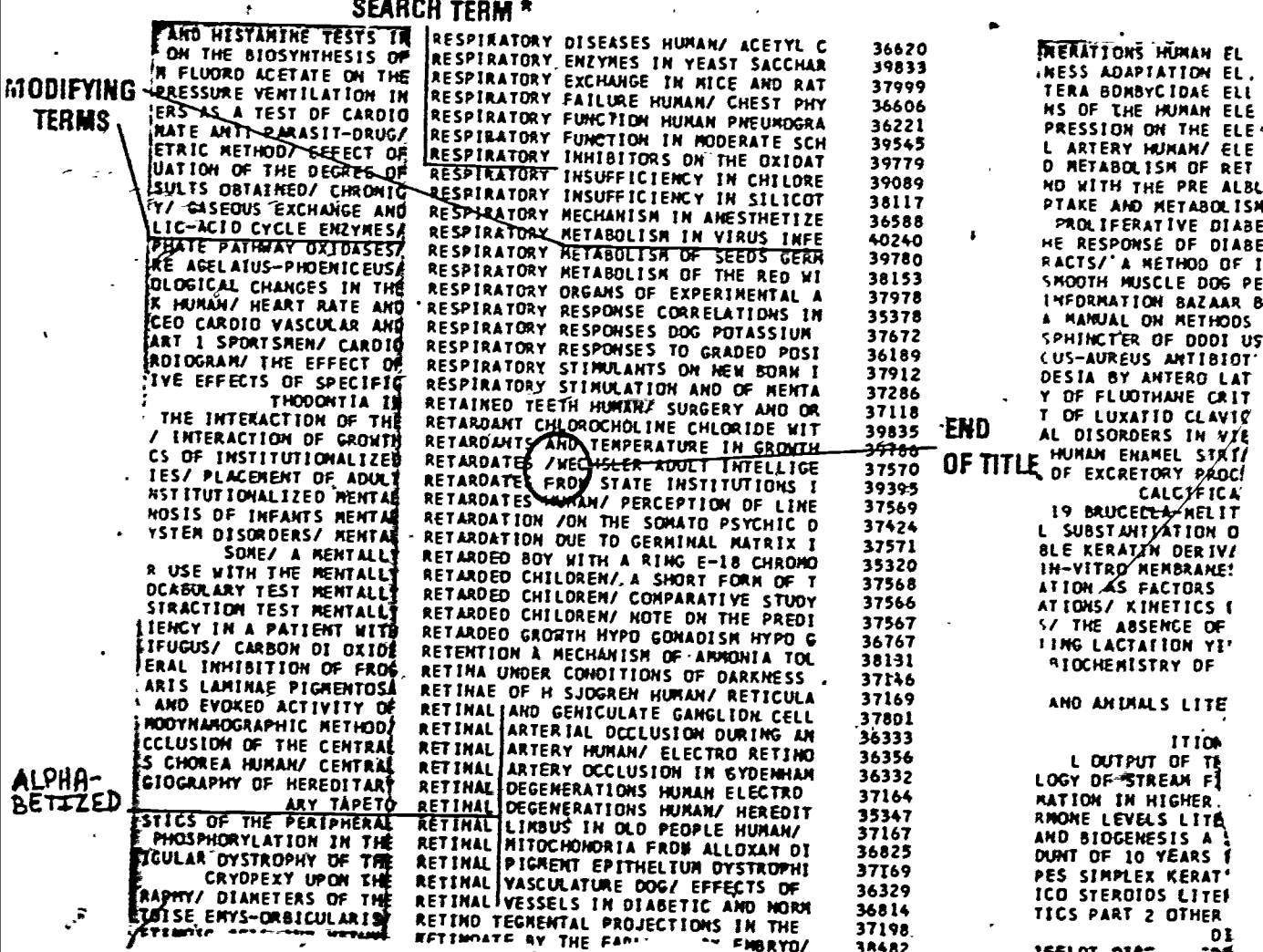
The index simply lists authors' last names and initials. All authors of an article are indexed not just the first author.

MULTI-AUTHOR PAPER

Example 3: subject index.

Also called a key word index because it is constructed from the important (key) words from the title of the article. Original terms used by the author remain unchanged. In addition, key terms are provided by the scientific editorial staff and added at the end of the title.

Each line in the index represents a new title which contains the key word being alphabetized.



*Beginning in 1974, the search term is not repeated in later lines. So, for example, "Respiratory" is printed only in the first line in which it appears and in subsequent lines, that space is left blank.

A key word index is a type of subject index which provides access to printed information through the most important words (most important to the discipline, e.g., biology) in the abstract or title of an article.

B.A. uses the title as given by the author plus modifying words which will make it possible for the modified title to be indexed under important terms it did not originally contain. The most frequently added words are scientific names of organisms where only common names are used in the title (up to 1974); geographical locations when they are important to the research; and other modifying phrases of which enzyme, instrumentation, review, and monograph are but examples.

To illustrate the difference between the conventional subject index and B.A.'s key word index, an article by Parry, "Mitotic recombination induced by ultraviolet light in synchronous cultures of yeast," is indexed by the two methods below.

Conventional Index

Saccharomyces, gene recombination
Linkage recombination

BASIC Index of B.A.

	(alphabetical sequence)
UV LIGHT IN SYNCHRONOUS	CULTURES OF YEAST/MITOTIC RECOMBINA
ECOMBINATION INDUCED BY	INST UV LIGHT IN SYNCHRONOUS CULTURE
TION INDUCED BY INST UV	LIGHT IN SYNCHRONOUS CULTURES OF YEA
NOUS CULTURES OF YEAST/	MITOTIC RECOMBINATION INDUCED BY INS
TURES OF YEAST/MITOTIC	RECOMBINATION INDUCED BY INST UV LTG
CED BY INST UV LIGHT IN	SYNCHRONOUS CULTURES OF YEAST/MITOT

In addition to the title, additional indexing terms such as generalized terms (e.g., inst., rev., etc.), geographical locations, and taxonomic names are added to the title. Thus some specialized articles appear in the index under a general term. However, the index is not always consistent. This means that you will always want to check the common and scientific name whenever you are interested in a particular organism or group of organisms, up to 1974. (After 1974 there is a separate "Generic Index" which you should search in addition to the common name in the "Basic Index".

Earlier it was noted that a good background knowledge of the field is necessary for effective use of B.A. This knowledge is needed in order to correctly list the key words to be used in a search. To do this you need to know something of the language of the area: common and scientific names of organisms involved, the meaning of vocabulary, word relationships, and synonyms. If all this is known ahead of time and the key words have been carefully gathered, a search in B.A. will be greatly facilitated.

From Pontecorvo, Advances in Genetics, vol. 9, pages 71-73, select the key words which best represent the topic fungal chromosome mapping by mitotic recombination. (There are photocopies of Pontecorvo on reserve.) List the key words in order of usefulness.

Genetic analysis (=chromosome mapping)
Mitotic recombination
Fungi (a possibility but too general to be really useful)
Crossing over (= mitotic crossing over)
Aspergillus nidulans
A. oryzae
A. sojae
linked markers
linkage groups

Now that you have completed this list, this does not mean it will remain unchanged. It should constantly be revised by dropping and adding terms as it seems appropriate.

Search the index of B.A. for 1968, using genetic analysis (= chromosome mapping), mitotic recombination, mitotic crossing-over, and Aspergillus nidulans. Are there any entries that appear useful? What are they? What number follows the entry? (Select only a couple of the most useful.)

Following is a list of all the useful articles that could have been listed.

Genetic analysis:

E IN ASPERGILLUS-NIGER/	*GENETIC ANALYSIS BY MEANS OF THE PAR*	*27273*
OLI/THE BEGINNING OF A	*GENETIC ANALYSIS OF RECOMBINATION PR*	*35493*

Chromosome mapping:

Nothing

Mitotic recombination:

INE/INST X RAY INDUCED	*MITOTIC RECOMBINATION GENE CONVERSIO*	*103203*
ON/ ON THE MECHANISM OF	*MITOTIC RECOMBINATION IN ASPERGILLUS*	*86969*
NS/ ON THE MECHANISM OF	*MITOTIC RECOMBINATION IN ASPERGILLUS*	*86970*
AND THE POSSIBILITY OF	*MITOTIC RECOMBINATION IN SCHIZOSACCH*	*21841*
NOUS CULTURES OF YEAST/	*MOTITIC RECOMBINATION INDUCED BY INS*	*103200*
ROSPHILIA-MELANOGASTER/	*MITOTIC RECOMBINATION IN FRECKLED C*	*38197*

Mitotic crossing-over:

N SPOTS AS EVIDENCE FOR	*MITOTIC CROSSING-OVER IN ASPERGILLUS*	*11099*

Aspergillus nidulans:

GENIC RECOMBINATION IN	*ASPERGILLUS-NIDULANS/ THE NATURE OF*	*86967*
IOTIC RECOMBINATION IN	*ASPERGILLUS-NIDULANS I INTRA GENIC*	*86969*
IOTIC RECOMBINATION IN	*ASPERGILLUS-NIDULANS II SIMULTANEOUS*	*86970*
THE 8 LINKAGE GROUPS OF	*ASPERGILLUS-NIDULANS/A REVISED MAP*	*291*

Be sure that you understand all markings in each line of the index. Symbols such as / are explained in the introductory guide.* The number that follows each line is the abstract number. In the earlier volumes of that year this number can be located. There you will find the bibliographic information and abstract for that item.

Who wrote, "On the mechanism of mitotic recombination in Aspergillus . . . in" (86969)?

*Shelved with the current issues of B.A.

Alexandra Putrament.

The other parts of this entry (86969) in the order of their appearance are: co-authors, place of work of the primary author, title of article, journal title, journal's volume and issue number, pages in the article, year of publication, and finally the abstract.

Note abstract 86962. This item is in a foreign language, but the English translation of the title is included in the entry.

Now repeat the search in the first half of 1974 (volume 57) of B.A. using "genetic analysis" or "mitotic recombination" (don't do both). List only the articles that really look like they might be useful.

The following are potentially useful, but there are none of which you can be certain from the information in the index.

Genetic Analysis:

	(GENETIC)	
HIA-COLI GENETIC MAP/	*ANALYSIS OF COLD SENSITIVE*	*66145*
OF MUTANTS MAPPING/	*ANALYSIS OF THE RECF PAT*	*43097*

Mitotic recombination:

	(MITOTIC)	
NESULFONATE INDUCED	*RECOMBINATION IN A DI-PLOID*	*2324*

Beginning in 1974, all generic names have been removed from the subject index of Biological Abstracts and placed in a separate "Generic Index." Below is a sample entry from the "Generic Index."

Genus name	Species name	Subject aspect	Abstract #
HOMO		ANTHROPOLOGY	27668
HOMO-	ERECTUS	MAMMAL SYST	21257
HOMO-	SAPIENS	GENET ANIMAL	66179

The first article shown above is on the genus Homo while the other articles are about individual species.

The "Subject Aspect" attempts through the abbreviated heading, of which there are some 500, to tell you something about the subject of the article. The list of headings with their explanations is located after the author index.

Search the first half of 1974 (vol. 57) "Generic Index" for articles on Aspergillus and specifically Aspergillus nidulans. (Note: B.A. also publishes a "Biosystematic Index" which indexes by taxonomic units above the genus level (e.g., order, family.) Do not search the wrong index!) How many articles on the genetics of Aspergillus and Aspergillus nidulans are listed?

For Aspergillus there are none listed; for A. nidulans there are 16 articles.

Normally you would look up there articles to see if any of them are useful to your topic. We will not do it here for the sake of brevity in the exercise.

How frequently are the individual issues of Biological Abstracts published? How frequently are the cumulative indexes published?

Regular issues of Biological Abstracts are published twice monthly and are accompanied by a complete set of indexes for that issue. These indexes are cumulated semi-annually.

This completes the exercise. Keep in mind that it has not tried to show all the steps used in a literature search, nor has it uncovered all the little facts and tricks you will eventually learn from actually doing a search on your own. It is hoped the exercise has explained some of the bibliographic tools you will use and has demonstrated the basic techniques of literature searching.

Now that you have completed the exercise, you should test your comprehension of the content of this exercise. You should come to the library sometime during the day on the day your exercise is due and turn in your exercise responses and take the 15 minute quiz which will check your comprehension of the exercise. You will receive your grade on the quiz the next day in your mail box.

Bibliography of General Reference Sources

for

Ecological Biology

Prepared by Thomas Kirk

September, 1977

Table of Contents

I. Style Manual and Guide to the Research Paper

Permanent Reserve

Council of Biology Editors Style Manual. 3rd ed., 1972. Permanent Reserve. Sci/Ref/Z/250.6/B5/C6.2.

It is "designed for research workers preparing manuscripts for publication in biological journals and for students and other prospective authors. Style is interpreted broadly to mean forms of expression in scholarly writing, and the general technical requirements of journals, such as details for typing manuscripts, standard abbreviations, and citation of references." Use of footnotes and form of literature citations can be found on pp. 152-165.

Sci Ref PE 1478 H6

Hook, Lucyle. The Research Paper; Gathering Library Material, Organising and Preparing the Manuscript. Sci/Ref/PE/1478/H6/1962.

This is one of the best guides to aspects of writing a research paper in any field: outlining, notetaking, mechanics of manuscript form, and general library research. This latter section is not terribly useful since it is somewhat out of date, and too general in focus for your purposes. You will find it useful if you need guidance in taking notes, outlining your topic, and in the mechanics of putting together the manuscript. Do not use the footnote style suggested in book. Instead see the title above.

II. Dictionaries

Dictionaries and Encyclopedias are shelved separately from other reference books. If you do not know their location, consult the floor plans posted in the library.

Dictionaries of biology and the specialized dictionaries in the various fields of biology will be the most frequently used reference tool of the beginning student. They provide the short, and hopefully, precise, accurate information one wants.

Sci Ref QH 302.5 M3

McGraw-Hill Dictionary of the Life Sciences. 1976.

This is the best general biology dictionary available. Provides concise definitions of biological terms and identifies the major taxonomic groups, phyla, classes, families, and many genera.

Other dictionaries which cover biology in general are:

Sci Ref QH 13

Abercrombie, Michael. *A Dictionary of Biology.* 1966. Sci/Ref/QH/13/A2.5/1966.

Henderson, Isabella F. *A Dictionary of Biological Terms.* 8th ed., 1963. Sci/Ref/QH/13/H3.8/1963.

Steen, Edwin B. *Dictionary of Biology.* 1971. Sci/Ref/QH/13/S7.4.

The dictionaries and encyclopedias in specialized fields which will be useful to you include:

Biochemistry:

see Chemistry and/or Medicine and Drugs

Botany:

Sci/Ref QK 9

Jackson, Benjamin Daydon. *A Glossary of Botanic Terms.* 4th ed., 1928. Sci/Ref/QK/9/J3/1965.

Not useful for modern terms. Some definitions no doubt are dated.

Chemistry:

Sci/Ref QD 5

The Condensed Chemical Dictionary. 6th ed., 1961. Sci/Ref/QD/5/C5/1961.

International Encyclopedia of Chemical Science. 1964. Sci/Ref/QD/5/I6.

Sci/Ref. QP 512

Stenesh, J. *Dictionary of Biochemistry.* 1975. Sci/Ref/QP/512/S7.3

Williams, Roger John. *The Encyclopedia of Biochemistry.* 1967. Sci/Ref/QP/512/W5.

Articles frequently conclude with bibliographies.

Ecology:

Sci/Ref QH 541

Carpenter, John Richard. *An Ecological Glossary.* 1938. Sci/Ref/QH/541/C3/1956.

Fungi:

Sci/Ref QK 603

Ainsworth, G. C. *Dictionary of the Fungi.* 1963. Sci/Ref/QK/603/A5/1963.

Snell, Walter H. *A Glossary of Mycology.* Rev. ed. Sci/Ref/QK/603/S5.3/1971.

Genetics:

Sci/Ref QH 431

King, Robert C. *A Dictionary of Genetics.* 1968; 2nd ed., 1974. Sci/Ref/QH/431/K5.5.

Rieger, Rigomar. *A Glossary of Genetics and Cytogenetics.* 3rd ed., 1968. Sci/Ref/QH/431/R4.913/1968.

Geology:

Sci/Ref QE 5

Challinor, John. *A Dictionary of Geology.* 3rd ed., 1967. Sci/Ref/QE/5/C4.5/1967.

Medicine and Drugs: (See also Chemistry)

Sci/Ref R 121

Black's Medical Dictionary. 29th ed., 1971. Sci/Ref/R/121/B5.98.

Sci/Ref RS 151.2

Dispensatory of the United States of America. 26th ed. and 27th ed., 1967, 1973. Sci/Ref/151.2/D5

Permanent Reserve and Sci/Ref RS 356

Merck Index. 8th ed., 1968. One copy each on Permanent Reserve and in Reference. Sci/Ref/RS/356/M5.24/1968.

Subtitled: An encyclopedia of chemicals and drugs. Be sure to use the "Cross Index of Names," as many drugs have several possible names, only one of which is used to list the compound in the main sections.

Sci/Ref RS 75

Physicians' Desk Reference to Pharmaceutical Specialties and Biologicals (commonly referred to as PDR). 31st ed., 1977. Sci/Ref/RS/75/P5

Sci/Ref R 121

Stedman, Thomas L. *Stedman's Medical Dictionary.* 21st ed., 1966. Sci/Ref/R/121/S8/1966

Microbiology:

Sci/Ref QR 9

Jacobs, Morris Boris. *A Dictionary of Microbiology.* 1957. Sci/Ref/QR/9/J1.8

Oceanography:

Sci/Ref GC 9

Fairbridge, Rhodes Whitmore. *The Encyclopedia of Oceanography.* 1966. Sci/Ref/GC/9/F3.

U. S. Naval Oceanographic Office. *Glossary of Oceanographic Terms.* 2nd ed., 1966. Sci/Ref/GC/9/U5/1966.

Sci/Ref SH 201

Firth, Frank E. *Encyclopedia of Marine Resources.* 1969. Sci/Ref/SH/201/F5.6/1969.

Ornithology:

Sci/Ref QL 673 — Thomson, Arthur Landsborough. *A New Dictionary of Birds.* 1964. Sci/Ref/QL/673/T4.8

Zoology:

Sci/Ref QL 50 — *Larousse Encyclopedia of Animal Life.* 1967. Sci/Ref/QL/50/L3.2.

Leftwich, A. W. *A Dictionary of Zoology.* 3rd ed., 1973. Sci/Ref/QL/9/L4.

Sci/Ref QL 9 — Pennak, Robert William. *Collegiate Dictionary of Zoology.* 1964. Sci/Ref/QL/9/P4.

III. Encyclopedias

General

Encyclopedia Britannica, the most scholarly of the three adult American general encyclopedias, has the most extensive articles on biology. These include excellent photographs and diagrams which add much to the articles. Good selective bibliographies are included. *Collier's* and the *Americana* have shorter articles, but sometimes cover material not in *Britannica.*

These articles are important because their survey coverage gives an entry-point into the subject. They have further importance in that they are written by experts in the field. For example, Dr. Viktor Hamburger, Professor and Chairman of the Department of Zoology at Washington University, St. Louis (Embryology, Experimental: *Britannica*) and Dr. Roberts Pugh, author, *Vertebrate Embryology,* and *Experimental Embryology* (Embryology: *Collier's*).

It is important to use the index to any encyclopedia first. It helps in finding related elements of a main topic as well as in pinpointing more quickly the location of the information wanted. In the *Britannica*, for example, there are 125,000 index entries for 25,000 articles; the chances are, then, your topic may be found in five different places.

AE 5 E3.63 — *Encyclopedia Britannica* — 1974 ed., Lilly Ref/AE/5/E3.63/1974; 1970 ed., Wildman Sci/Ref/AE/5/E3.63/1970

AE 5 C6.83 — *Collier's Encyclopedia* — 1968 ed., Lilly Ref/AE/5/C6.83/1968; 1965 ed., Wildman Sci/Ref/AE/5/C6.83/1965.

AE 5 E3.3 — *Americana* — 1971 ed., Lilly Ref/AE/5/E3.3/1971; 1967 ed., Wildman Sci/Ref/AE/5/E3.3/1967.

AE
5
E3.63

Encyclopedia Britannica 1974 ed., Lilly Ref/AE/5/E3.63/1974
1970 ed., Wildman Sci/Ref/AE/5/E3.63/1970

AE
5
C6.83

Collier's Encyclopedia 1968 ed., Lilly Ref/AE/5/C6.83/1968
1965 ed., Wildman Sci/Ref/AE/5/C6.83/1965

AE
5
E3.3

Americana 1971 ed., Lilly Ref/AE/5/E3.3/1971
1967 ed., Wildman Sci/Ref/AE/5/E3.3/1967

Scientific

Sci
Ref
Q
9
B7.8

Britannica Yearbook of Science and the Future. 1969- Sci/Ref/Q/9/B7.8

These annual volumes provide an elementary level survey of developments in science in the previous year. Besides reporting on new developments, background information is provided. Articles are written by authorities in the fields covered (e. g. S. L. Washburn, "The New Science of Human Evolution," 1974; Francis Crick, "The Language of Life," 1969; Anatol Rapport, "Game Theory: Strategies for Resolving Conflict," 1970). Articles are concluded with a list, "For Additional Reading." Index to most recent volume also covers the two previous volumes.

Ref
Q
121
M

McGraw-Hill Encyclopedia of Science and Technology.
4th ed., Sci/Ref/Q/121/M3/1977
3rd ed., Lilly Ref/Q/121/M3/1971
Yearbooks Sci/Ref/Q/121/M3.12

Excellent general encyclopedia with good illustrations. Its value rests in the recent date of publication and the true "modernness" of the material presented. Every effort has been made to present surveys of subjects in the context of recent developments.

Use should always start with the index for many subjects have various related aspects which are scattered in other articles. A good example is "Chromosome." Although the majority of the material is in volume 3, there is other related material in volumes 1, 2, 4, 6, 7, 8, 9, 10, 11, and 12.

Bibliographies are included with most articles.

The yearbooks are important additions to this set until a new edition is published. Each volume contains an index.

Lilly/Ref
Q
3.3

Science Year, the World Book Science Annual. 1969- Lilly/Ref/Q 9/S3.3

This annual review of science contains approximately 15 articles which provide elementary level summaries of recent developments in "hot topics" which are science oriented or related (e.g. birth control, energy, pollution, space exploration, new technologies). In addition there are summaries of new developments in the various fields of science (e.g. agriculture, biology, chemistry, oceanography, psychology, and space exploration). There are biographies of a few prominent scientists, and a listing of prize winners for the previous year. The index covers the volume and the two previous ones.

Sci/Ref on counter

Van Nostrand's Scientific Encyclopedia. 5th ed., 1976. Sci/Ref/Q/121/V3/1976.

While only a one-volume work, it is one of the most complete dictionary-encyclopedia reference tools available. For specific terms there are concise definitions; in addition, subjects, concepts, and fields of science are allotted varying amounts of space.

There is no index, but extensive cross-references direct the user to the proper entry. Illustrations are extensively used. There are no bibliographies.

Biological

Sci/Ref QH 13 G7

Gray, Peter. *The Encyclopedia of the Biological Sciences.* 2nd ed., 1970. Sci/Ref/QH/13/G7/1970.
/1961. Sci/Ref/QH/13/G7.

"Intended to provide succinct and accurate information for biologists in those fields in which they are not themselves experts." (Introduction) Articles are signed and furnished with bibliographies, and the book has an index. It covers the developmental, ecological, functional, genetic, structural, and taxonomic aspects of the biological sciences. It provides definitions and descriptions midway in depth between a dictionary and a multi-volume encyclopedia or a text in the field.

Sci/Ref QL 45

Grzimek's Animal Life Encyclopedia. 1972-76. Sci/Ref/QL/45/G8.1.

Major reference encyclopedia for classification, evolution, ecology, natural history, and behavior of the world's animal life. The 13 volume work covers 7 categories: lower animals; insects; mollusks and echinoderms; fishes and amphibia; reptiles; birds; and mammals. The many excellent diagrams and color plates make for interesting reading for the layman, while its comprehensiveness and authority make it useful to all but the specialist. The volumes are not arranged in alphabetical order, therefore, the extensive indexes must be used. Each volume has, just before the index pages, a "Supplementary Readings" section which is a select list of books and monographs on the animal groups covered in the volume.

Ecology

Sci/Ref QH 540.4 G7

Grzimek's Encyclopedia of Ecology.

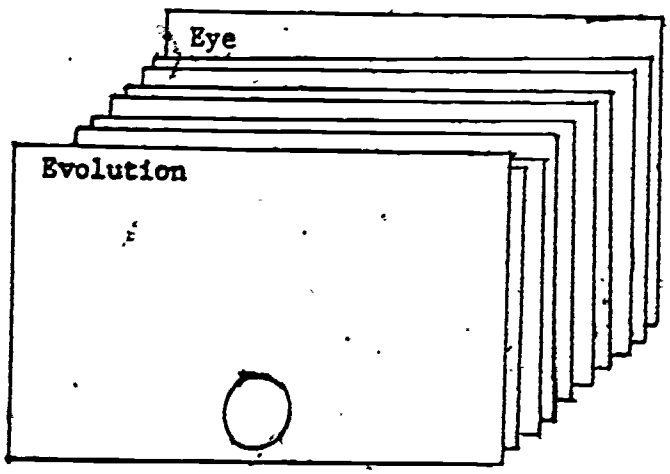
A one volume supplement to Grzimek's famous *Animal Life Encyclopedia*, the *Encyclopedia of Ecology* contains articles, separately authored, on aspects of the environment. It is divided into two main sections:
1) descriptions of the physical, chemical and biological aspects of the environment in relation to animal life
2) discussions of the various ecological crises and their effects on man.
The encyclopedia is well illustrated and useful for the novice as well as for a person familiar with the field. An index and a supplementary reading section are also included.

IV. The Card Catalog

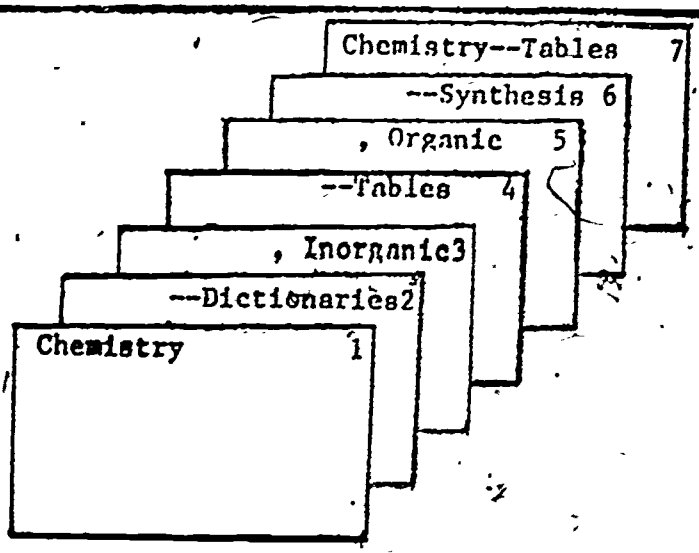
The Earlham card catalog is divided into two sections. One is the author-title catalog. In this catalog are filed the author and title cards (not all books have title cards) for the books in the library. Here also are cards for government agencies, societies, institutions, organizations when they are the author of the book or item. One other group of entries in the author-title catalog is the established entries for symposia, conferences and other meetings out of which comes a printed document.

The only two groups of items which are generally excluded from the card catalog are: government documents which should be consulted through the *Monthly Catalog of United States Government Publications* with the assistance of the reference librarian; and periodical titles which are listed in a separate file in the upper right corner of the author-title catalog.

The second section of the card catalog is the subject catalog. In this are cards which provide a subject access to the library book collection. In this file are slightly higher plastic-covered cards that have typed on them subject headings. Behind each subject heading card are cards for each book on that subject, arranged alphabetically by the top line on the card (usually the author). Thus, in the subject section of the card catalog you might see:



Following is a sample of subject heading types and how they appear in the card catalog:



1) Major headings *
2) Subheading of "Chemistry"
3) Inverted heading of Inorganic chemistry
4) Tables is a subheading of Inorganic chemistry
5) Inverted heading of organic chemistry
6) Subheading of organic chemistry
7) Subheading of chemistry

Whenever a subheading does not refere to the heading directly in front, the heading to which it does refer will be typed to the left on the same card (see # 7 above).

*The subject headings used in the card catalog are of four types. They include:

1. Regular one or two word heading — Examples: Biology, Natural selection
2. Inverted heading — Examples: Botany, Economic; Zoology, Experimental
3. Phrase heading — Examples: Books and reading; Life on other planets
4. Subheadings: these are words which subdivide any of the three heading types above. — Examples: Life--Origin; Brain--Atlas

In all cases a strict alphabetical order is followed. This may seem complicated, and it is to some extent. However, other systems are even more complex. To simplify things, use the thesaurus of subject headings: *Subject Headings Used in the Dictionary Catalog of the Library of Congress* (large books on top of the counter by the subject catalog). The librarian will be happy to show you how to use it.

Science Citation Index. 1964-

Sci Biblio- raphy Area

A directory containing all references cited in the bibliographies and/or footnotes of source articles published in a large number of scientific journals and all U. S. patents during the year. The most characteristic feature of the *Science Citation Index* is that the user begins a search with a specific known paper (target reference). From this starting point one is brought forward in time to subsequent papers related to the earliest paper. Covers biology, chemistry, medicine, psychology, mathematics, physics, geology, and others. Geology is only lightly covered.

An easy tool to use, once one adjusts to the unique technique involved. Anyone concerned with searching scientific literature should use it extensively.

Biological Abstracts. vol. 1, 1926-to date.

A comprehensive abstracting and indexing journal of the world's literature in theoretical and applied biology, exclusive of clinical medicine. The latest list of serials covered and word abbreviations are listed in a separate pamphlet shelved with the current issue of *B. A.* New serials abstracted are listed in the front of each semi-monthly issue of the abstracts.

A special word about B.A.S.I.C. is necessary. *Biological Abstracts* uses B(iological) A(bstracts) S(ubjects) I(n) C(ontext), which is made possible by computer indexing. Each significant word in a title is indexed and alphabetically positioned to the center of a line which also includes several words preceding and following. Reference is then given by abstract number to the appropriate issue of *Biological Abstracts*. A conventional subject index was used from 1926 to October, 1961. In November, 1961, the computer-produced key word index (B.A.S.I.C.) was first used and continues to the present. Each semi-monthly issue includes:

1) The Abstracts
2) Indexes
   a) Author
   b) Subject (B.A.S.I.C.)
   c) Biosystematic-indexes by large taxonomic groups: classes orders, etc.
   d) Generic-indexes by genus names
   e) CROSS-elaborate index for comprehensively searching broad topics

VI. Serials

Serial File

The drawers in the upper right portion of the Author-Title Card Catalog contain a list of the serials (periodicals, annuals, series, etc.) which the Wildman Science Library has. The cards are in alphabetical order and indicate our holdings and whether they are bound, unbound, or in microform (microfilm or microfiche). If a card in the file indicates that you should check the shelves under a call number or should check the card catalog under the author's name, then the item is not a periodical, and you should follow the directions given. If the title is given in capital letters, then the item is a periodical and may be found shelved in alphabetical order at the west end of the library on the lower level.

The serials file also serves as a union list of scientific periodicals held by the libraries of Richmond. By checking this file, you can find out if a particular title is held somewhere else in the city: Morrisson-Reeves Public Library, the Richmond High School Library, or Reid Hospital Library. Please consult the librarian about hours and rules for use of these libraries.

Periodicals in the areas of general science, history and philosophy of science, psychology, and popular science and conservation which are not in the Wildman Science Library may be in Lilly Library. To find out, check the *Indiana Union List of Serials* which is located on the counter to the right of the Author-Title Catalog.

Annual Reviews

In recent years (since the late 1940's) a new class of scientific literature has developed and become one of the most important sources of information for the undergraduate. The reviews can be described as a series of annual volumes under the various titles "Advances in," "Annual Review in," "Reviews in," or "Progress in." Each annual* volume consists of from 4 to 15 articles on a particular subject. The article is a review of the field drawing upon a lengthy but selective list of references. Thus the reviews are good sources of bibliographic references as well as a review of the subject. Most volumes have a detailed subject index and an index of authors cited.

Below are listed these review series and review-type periodicals useful to biology students which the Wildman Science Library receives:

Agriculture:

Advances in Agronomy. Sci/S/405/A2.4/ Annual subject index; Cumulative indexes in vol. 16 covers volumes 1-15.

Agricultural Science Review. Periodical. No indexes.

*Usually. Some titles are published every other year.

Behavior:

Advances in the Study of Behavior. Sci/QL/750/A3.8. Annual subject index; Cumulative tables of contents--see front of latest volume.

Biochemistry:

Advances in Enzymology and Related Subjects of Biochemistry. Sci/QP/601/A1/A3. Annual subject index; Cumulative title index in volume 35 covers vols. 1-35.

Annual Review of Biochemistry. Sci/QP/501/A7. Annual subject index; Cumulative title indexes--see latest volume.

Annual Review of Pharmacology. Sci/RM/16/A63. Annual subject index; Cumulative title index--see latest volume.

Essays in Biochemistry. Sci/QH/345/E8. Annual subject index; Cumulative tables of contents on back cover of latest volume.

Biology (General):

American Scientist. Periodical. Annual subject index; Cumulative index for volumes 34-61.

Quarterly Review of Biology. Periodical. Annual subject index; No cumulations.

Biophysics:

Annual Review of Biophysics and Bioengineering. Sci/QH/505/A1. Annual author index; Cumulative author and title indexes--see latest volume.

Botany:

Advances in Botanical Research. Sci/QK/1/A3.33. Annual subject index; No cumulations.

Annual Review of Phytopathology. Sci/SB/599/A68. Annual subject index; Cumulative title index--see latest volume.

Annual Review of Plant Physiology. Sci/QK/1/A5. Annual subject index; Cumulative title index--see latest volume.

Botanical Review. Periodical. No annual subject index; Separate cumulative subject index (plant names only) for volumes 1-25.

Cells-Physiology:

Annual Review of Physiology. Sci/QP/1/A5.35. Annual subject index; Cumulative title index--see latest volume.

Current Topics in Bioenergetics. Sci/QH/511/A1/C8.7. Annual subject index; Cumulative tables of contents follow "Preface" of latest volume.

International Review of Cytology. Sci/QH/573/I5. Annual subject index; Cumulative tables of contents--see latest volume.

Physiological Reviews. Periodical. No annual indexes; Separate cumulative subject index for volumes 32-46 (Earlham has v. 45-to date only).

Photophysiology. Sci/QH/651/G5.3. Annual subject indexes; Cumulative tables of contents follow "Preface" of latest volume.

Development:

Advances in Morphogenesis. Sci/QH/491/A2.5. Annual subject index; No cumulations.

Current Topics in Developmental Biology. Sci/QL/951/C8. Annual subject index; Cumulative tables of contents--see front of latest volume.

Ecology:

Advances in Ecological Research. Sci/QH/540/A2.3. Annual subject index; No cumulative indexes.

Advances in Environmental Science and Technology. Sci/TD/180/A3.8. Annual subject index; No cumulations.

Annual Review of Ecology and Systematics. Sci/QH/540/A5.3. Annual subject index; Cumulative title index--see latest volume.

Evolution:

Evolutionary Biology. Sci/QH/366/A1/E9. Annual subject index; No cumulations.

Genetics:

Advances in Genetics. Sci/QH/431/A1/A3. Annual subject index; Cumulative index for volumes 1-16.

Advances in Human Genetics. Sci/QH/431/A1/A3.2. Annual subject index; No cumulations.

Annual Review of Genetics. Sci/QH/431/A1/A3.4. Annual subject index; Cumulative title index--see latest volume.

Invertebrates:

Advances in Insect Physiology. Sci/QL/495/A2.3. Annual subject index; Cumulative list of chapter titles--see latest volume.

Annual Review of Entomology. Sci/QL/461/A5. Annual subject index; Cumulative title index--see latest volume.

Marine Biology:

Advances in Marine Biology. Sci/QH/91/A1/A2.2. Annual subject index; Cumulative title list--see latest volume.

Oceanography and Marine Biology. Sci/G/Y/03.2. Annual taxonomic and subject indexes; No cumulations.

Medicine (see also Biochemistry):

Annual Review of Medicine. Sci/R/111/A5. Annual subject index; Cumulative title index--see latest volume.

Nutrition Reviews. Periodical. (Early volumes on microfilm). Annual indexes.

Microbiology:

Advances in Applied Microbiology. Sci/QR/1/A3.8. Annual indexes.

Advances in Virus Research. Sci/QR/360/A3. Annual indexes. Volume 11 contains cumulative index for volumes 1-11.

Annual Review of Microbiology. Sci/QR/1/A5. Annual subject index; Cumulative title index--see latest volume.

Bacteriological Reviews. Periodical. Annual subject index; Cumulative subject index for the following volumes: in volume 34: 27-34; in volume 26: 23-26; in volume 22: 11-22.

Parasitology:

Advances in Parasitology. Sci/QH/547/A3.8. Annual subject index; No cumulations.

Physiology:

see Cells-Physiology

Science:

Scientific American. Periodical. Annual Subject index; Cumulative index, 1948-1971.

VII. W. C. Allee Memorial Collection in Environmental Science

W. C. Allee, one of America's outstanding ecologists during much of the first half of the twentieth century, was a student at Earlham (B.S., 1908). After his death, his personal collection of reprints (copies of journal articles) was given to Earlham. From the time it was given until about 1966, the collection was maintained by the Biology Department. Through the efforts of Dr. Murvel Garner, Dr. Carrolle Markle, many students, and others, the collection was enlarged through regular addition of materials. Because of the crowded conditions, the collection was not properly attended to during the period from 1966 until the Spring of 1968.

Since 1968, the collection has been under the care of the Wildman Science Library and has been added to regularly since January, 1969. As items are added to the Collection they are checked against *Biological Abstracts*. If a reprint is found abstracted in *B. A.*, the abstract is stamped "Reprint: Allee Coll."

Here are a few suggestions related to its use. The collection is very strong on older material in ecology and behavior, in particular, but also in other areas of zoology--genetics, evolution, etc. There are also many items in environmental science. If you find an item in *B. A.* that is stamped "Reprint: Allee Coll.", you simply check the collection under the author's name. If you come across a reference to an item, (especially one written before 1950 in any of the areas mentioned above) in a periodical which we do not have, check the Allee Collection.

VIII. Pamphlet File

The pamphlet file contains ephemeral materials including pamphlets, magazine clippings, letters, etc. which might be of interest to science students. The file can be consulted directly, but should probably be consulted through the Subject Card Catalog, since all folders in the file are indexed by subject in the card catalog. The collection is shelved next to the Author-Title Card Catalog.

Objectives for Library Instruction in Beginning Biology

Students should be able, on their own, to effectively and efficiently prepare a bibliography of up to ten primary sources on a specific topic, which a librarian and/or faculty member will judge as (a) up to date, and (b) authoritative.

To do this the student should know about:

I. General types of reference books and some specific examples

A. Encyclopedias: McGraw-Hill Encyclopedia of Science and Technology, 3rd edition, 1971, and Yearbooks.

B. Dictionaries

1. Gray, Dictionary of the Biological Sciences, 1967.

2. King, Dictionary of Genetics, 2nd ed., 1974.

C. Monographs

D. Serials

1. Periodicals

a. Science

b. Nature

2. Review serials

E. Bibliographies

II. Periodical indexes and scientific abstracting services

A. Biological Abstracts, its organization, how to use the author and key word indexes

B. Science Citation Index, its uniqueness, how to use it

III. The Library Card Catalog

The freshmen test indicates that Earlham students already know something about the use of the card catalog. They are not, however, prepared to use the subject portion of the catalog on a more advanced level. The instruction therefore needs to emphasize the use of the subject heading list (Library of Congress Subject Headings, 8th ed., 1975). This includes recognition and meaning of the see, see also to, and see also from references. The use of subject heading tracings applied to a book known by the students as a method of selecting subject headings is also to be covered.

IV. A general understanding of the organization of scholarly scientific literature and the relationships among various types

A. Journal and report literature (primary). The backbone of science or biology. The reports of original research.

B. Journals, monographs, reviews and review series (secondary). The synthesis and surveys of science.

C. Handbooks, dictionaries, encyclopedias, texts (tertiary). Literature intended for a specific purpose, which presents only specific information--data, or definitions. In addition, literature intended as instructional material, especially literature designed to provide a broad survey of a field for the beginner. This material is based on secondary sources.

V. Search strategy.

While most of the items listed above are concerned primarily with knowledge to be learned, this last item involves the behavioral aspects of library instruction. It requires knowledge of the basic search strategy which is the initial use of encyclopedias and texts, then a location of monographs and reviews, and finally a search of the periodical indexes. It also requires recognition of where to start the process with an individual search. Students should also recognize when a search step is no longer useful, when to retrace a step, and when to skip a step. One of the undefinable and unmeasurable, yet important aspects, is the development of a personal method of search and the confidence to use it efficiently.

VI. The analysis of a subject so that the proper questions might be asked of the literature. This is perhaps the most difficult of skills to teach and measure. This analysis is seen to include the answers to the following questions:

1. What is the subject? Its content? What fields are related to it?

2. Is the bulk of information in the field newly discovered or has it been well known for a number of years?

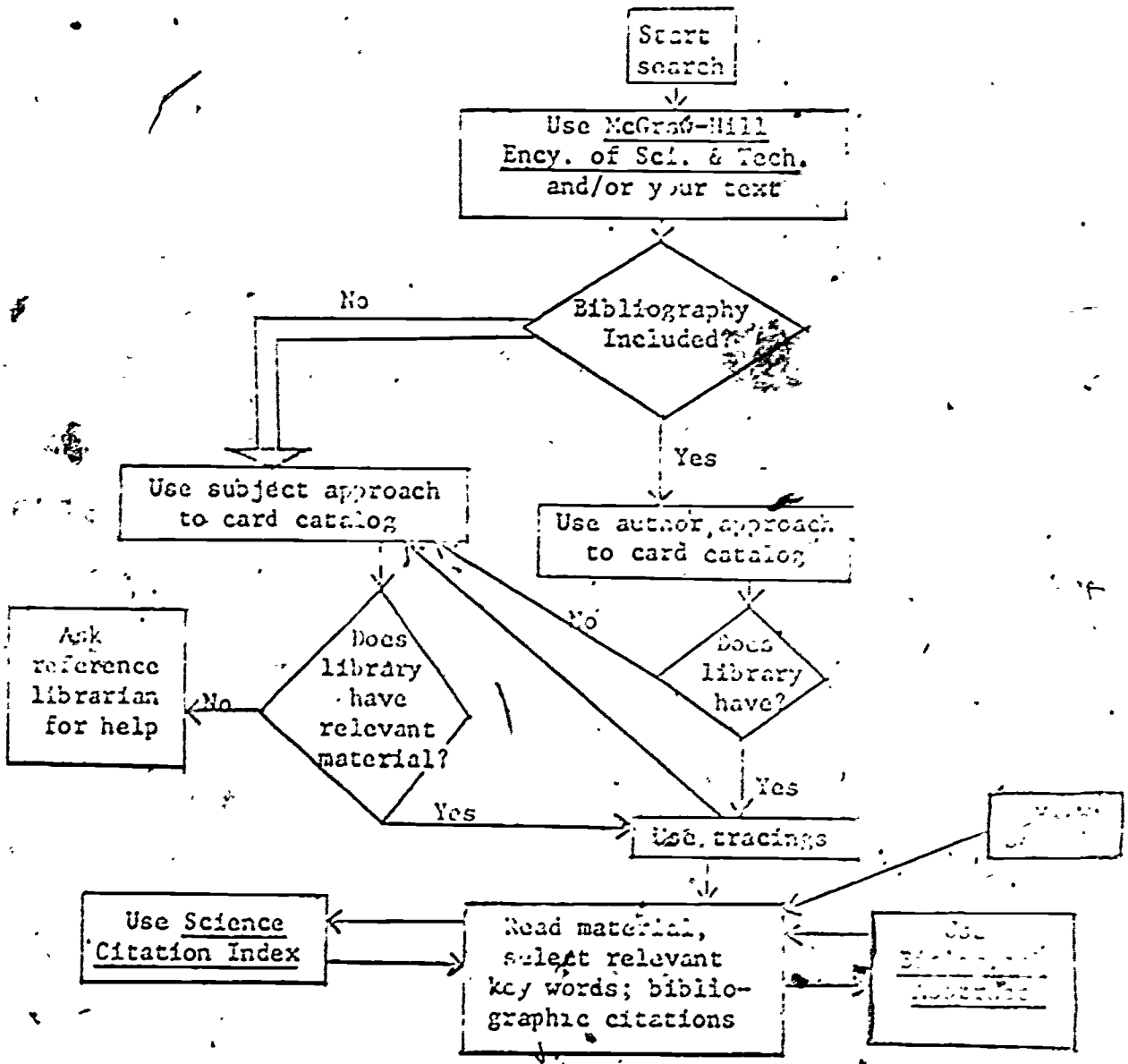
3. What are the controversial aspects or are the major questions of disagreement settled at present?

4. Who are the important scientists who have contributed to the subject?

5. Do certain organisms predominate as the objects of study for the subject of interest? (for example: Drosophila in genetics, Planaria in chemical learning)

6. How is the subject expressed by authorities in the field? Is the terminology confusing? Synonyms?

Figure 1. Simplified Search Strategy for Undergraduate Biology St...



General Biology
Earlham--Fall, 1974

LIBRARY EXAMINATION INSTRUCTIONS

This examination is to be written outside the classroom. You should attempt to limit yourself to an essay-type answer of five (5) double-spaced typewritten pages (250 words per page) or 1,250 words.

Should you want to include figures, tables, graphs, etc., in your paper, they should be attached to the back of the paper and should not be counted in the total of five pages.

The intentions of these library exams are several:

1. They provide an opportunity for data-based reasoning; that is, the operation of finding information in the library should be a data-collecting activity. Your answer to the question should be supported by the data. Since data is what you are looking for, primary sources, which report the results of research, should form the basis of your paper.

2. It is an opportunity for you to practice the techniques demonstrated in the library exercises you just completed.

3. The exam provides an opportunity to apply the subject matter you have just studied to a specific biological problem.

4. The exam is an opportunity for you to independently study a specific problem. You are free to select the specific examples you use for your discussion.

The examination is due in your laboratory section one week after you begin your assignment, unless told otherwise by your instructor. PLEASE put both your name and YOUR LABORATORY INSTRUCTOR'S NAME in the top right hand corner of the original copy of your paper. Put only the instructor's name on the carbon or xerox copy. (See below for carbon copy instructions)

You should budget your time working on this examination approximately as follows:

Time in library --6 hours
Time in organizing--1 hour
Time in writing --3 hours

Please provide at the end of your paper a list of all references used in preparing your answer for this examination and cite them in standard fashion (see CEB Style Manual, reserve shelf) in the context of your essays.

We would emphasize that you are free and encouraged to talk with anyone, students as well as faculty, while you are preparing to write you answer; but the expectation is that your answer will be yours and yours alone.

Please have respect for the library! You are not the only one using the library. We should urge you to be considerate of others. Do not at any time remove books or materials from the library without signing them out. Return them when due or before. Be sure to use your talents in the use of the library.

RATIONALE OF THE ANONYMOUS COPY

You must turn in a second copy of your answer without your name on it.

Objectives: To give you the opportunity to see different approaches to the question, to demonstrate the quality of work to your classmates, to provide more feedback evaluation for all of the students and to familiarize you with the difficulties of grading essay answers.

Procedure: You will be divided up into groups of four students each. Each student in your group will be given one anonymous paper to comment upon and grade. After completing you work on this paper, pass it along to the next person listed. Continue passing the paper along until each person in your group has read all four papers. Comment extensively on the papers in writing along the margins and between the lines. Summarize your grade and turn it in to the instructor. You may wish to conduct a group discussion on the four papers and then arrive at a consensus grade. If you do this, be sure to state this so as to distinguish it from the others. You may also wish to make further comments as a group.

All papers are to be graded anonymously so as to avoid personal conflicts between grader and graded. Turn in your graded set of papers by one week after the date exams are due.

The instructor will grade each of the papers in the usual way, independent of student graders. If his grade is significantly different form the student grades, the higher grade will be given more weight in setting the final grade. Both the copy and the original will be returned to the student who wrote the answer. However, one of these two should be returned to the instructor's files.

SOME SUGGESTIONS FOR PREPARING YOUR ANSWERS

1. Use 5 x 8 cards to collect your information from the library for writing the Paper. Put one reference on each card. After reading the reference and taking notes on it, list in the top right hand corner of the card the major points covered in that article. In this manner, you will be able to go through the cards after your literature search is done and pull all the cards on any given topic with ease.

2. Make an outline for your paper. Revise it as you read the literature. Revise it after you have completed reading the literature. We would suggest that the following topics be included in your paper.

   a. Some history and/or explanations....do not assume that the reader knows too much but do not assume the reader is a real dum-dum either. Make it brief and to the point so that the reader will have a point of reference when reading the remainder of your paper.

   b. Use sub-titles to categorize various factors you wish to discuss.

   c. Give the source of all information in the body of the paper; that is, refer to the literature per the method described in the CEB Style Manual. Include at the end of your paper a list of references cited.

   d. Write a brief summary at the end of the paper....be concise and only relate what you covered, not all the gory details.

3. Proofread and/or have someone else proofread your paper. This is not cheating as long as you do not let someone else write it for you.

4. Focus clearly on what you are discussing. Please leave out the wild elephants.

LIBRARY EXAMINATION QUESTIONS

1. Poor Smokey the Bear!! Now he is under attack by many ecologists who suggest he represents the idea that fire is always detrimental to a forest ecosystem. Research and discuss the "boon and bane" of fire from a woody perspective.

2. Describe the pollination of two species of plants by bats. Discuss the structural aspects of the relationship.

3. Lemmings are well known for their periodic eruptions in abundance. There are stories of lemmings taking suicidal leaps into the ocean. What hypotheses have been suggested to explain the cycles of abundance of lemmings? Is there any validity to the mass suicides of the popular literature?

4. Discuss the role of territoriality in determining the life style of an organism of your choice. Be sure to include a description of the type of territory employed, methods for delineating area and continuing ownership; and the effects of successful vs. unsuccessful maintenance of territory on the population of the species.

5. You are asked to discuss at least two hypotheses which might explain why there was more diversity in the lowland than the upland sample of forest that we obtained in Robinson's Woods on September 21st. Discuss the problem of causal factors in diversity as a general issue using secondary sources as a point of departure, then explore at least two specific hypotheses using the primary literature to provide data points.

PSYCHOLOGICAL PROCESSES

Basic Reference Sources in Lilly Library

Earlham College

February, 1976

Compiled by

Evan-Ira Farber
James R. Kennedy, Jr.

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Simplified Search Strategy for Undergraduate Psychology Students

Prepared by
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and
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Earlham College Library