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About the Institute
The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

B 170 Class - March, 1967

Paul Holden
Graduate Student
Fisheries
Interested in Taxonomy of the
minnows and how to determine this.

Mildred Thornton
Colorado State University
Interested in Seed taxonomy.

Tom Whitfield
Botany & Plant Pathology
Plant Taxonomy

Robert Behnke
Coop. Fish. Unit
Ichthyology

Ed Reed
Dept. of Zoology
Taxonomy of Copepods

Hiram Li
Coop. Fish. Unit
Taxonomy of the Genus Notropis

(Judy)
Mrs. Hiram Li
Dept. of Zoology
Taxonomy of Copepods

Paul H. Baldwin
Zoology Dept.
Ornithology

OUTLINE OF BOTANY 170. TAXIMETRICS

The following is an outline of the course rather than a lecture schedule. This method of presentation is offered rather than the lecture schedule because the course is "experimental" this year. Having no precise prerequisites, and having no idea whether students will be sufficiently well prepared to accept the total offered by this outline, we will most likely have to modify the content as we proceed.

Four staff members will participate in the course. The biological and taxonomic aspects will be taught by D.J. Rogers and H. Fleming, the mathematical aspects by G. Estabrook, and the computer aspects by K. Brill.

The method of presentation will be a combination of lecture, discussion, and practical application. Students will actually do a small, selected classification, run it through the computer, and interpret the results.

We want to keep the class small for the first run-through to allow more flexibility, and to give us more "feed-back" on the value of the presentation.

I. Definitions and description of taximetrics (syn.="numerical taxonomy").

- A. Application of numerical methods to non-numerical data in taxonomy.
- B. The place of taximetrics in the total field of biological taxonomy.
- C. The types of data used in classification process.

II. Historical review of taximetrics.

- A. Michel Adanson, 18th Century French biologist. non-weighted classification, and the subsequent controversies.
- B. The early efforts to quantify taxonomic classifications.
- C. Computers and their influence on taximetrics.

III. How is a computer used in classification?

- A. Simple description of the computer.
- B. How the circuitry of the computer lends itself to classification.
- C. Examples of use of computer in classification. (Psychology, anthropology, biology, social sciences)

IV. Introduction to fundamental mathematical concepts useful in taximetrics.

A. Arithmetic logic.
B. Sets
C. Unique determinations.
D. Functions and correspondence.

V. Biological foundations for taxonomy and ecology.

A. The "synthetic" versus the "analytic" aspects in biology.
B. The information derived from biological objects -- characters.
C. The role of characters individually and collectively in classification.
D. Defining taxonomic categories.
E. Hierarchical versus non-hierarchical classifications.
F. The formal taxa of biology.

VI. Developing rules and applications of mathematical thought processes appropriate to biological problems (fitting the mathematics to the biology rather than the opposite).

A. This, and the next section, will be student-participation procedures.

VII. Practical applications using existing methodologies -- "doing a classification."

ANNOUNCEMENT OF NEW COURSE-SPRING QUARTER, 1967

Botany 170: Taximetrics
Instructor: D. J. Rogers
Prereq: Introd. Biol. (Bot., Zool., Entom., Micro.) one course in systematics (same fields as above)

5 credits
Lectures: 10 MWF
Lab.: 3-5 MW

Text: Principals of Angiosperm Taxonomy. Davis & Heywood (1963).

OUTLINE OF BOTANY 170. TAXIMETRICS

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MON.	WED.	FRI.
	Mar. 23 D Introduction	Mar. 25 Introductory Lab.
Mar. 28 D History of Problems and Objectives	Mar. 30 B Computers - I	Apr. 1 Davis & Heywood Lab.
Apr. 4 B Computers - II	Apr. 6 G Math. - I	Apr. 8 Math. Problems
Apr. 11 G Math. - II	Apr. 13 H How to Describe Plants	Apr. 15 Examine Plants (Uvularia)
Apr. 18 H How to Set Up Characters	Apr. 20 H or D Problems in Finding Similarity Measures	Apr. 22 Code the Study
Apr. 25 G Solutions to Similarity Problems	Apr. 27 D What is a Biological Cluster?	Apr. 29 Test Clusters With Specimens
May 2 G Development of Numerical Method	May 4 G Brief Review of Other Methods	May 6 NO CLASS
May 9 B Role of Computing Machines in Bio Modeling	May 11 D or H How to Interpret Results	May 13 Prepare Data for Input
May 16 D Presentation of Results - I	May 18 D Present Results - II	May 20 Interpret Results
May 23 H or D Future Applications, Implications, etc.	May 25 H or D Recap	May 27 Make Classification

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May 23 H or D Future Applications, Implications, etc.	May 25 H or D Recap	May 27 Make Classification

1 Discussion of anything - D H B G plus class.

2 Davis & Heywood critical discussion of 1st few chapters.

3 Problem sessions in support of lectures 4, 5, 6.

4 Case study - discuss how to ~~describe~~ de some particular group of plants.
Re-describe case study with a similarity measure in mind.

6 Test definitions of clusters on the case study.

5 Actually code the case study.

7 Prepare data for machine.

8 Interpret the results.

9 Present the results.

MON.	WED.	FRI. (LAB)
	Mar. 23 Introduction – D	Mar. 25 Introductory lab
Mar. 28 History of Problems + Objectives D	Mar. 30 Computers - I B	Apr. 1 Davis + Heywood Lab
Apr. 4 Computers - II B	Apr. 6 Math - I G	Apr. 8 Math Problems G
Apr. 11 Math - II G	Apr. 13 ~~Math - III~~ How to describe Plants H	Apr. 15 Examine Plants (Umalaria)
Apr. 18 How to set up Characters H	Apr. 20 Problems in finding similarity measures H or D	Apr. 22 Code the study
Apr. 25 Solutions to Similarity Problems G	Apr. 27 What is a biological cluster? D	Apr. 29 Test clusters with specimens
May 2 Development of numerical methods G	May 4 Brief review of other methods G	May 6 NO CLASS
May 9 Role of computing machines in bio modelling B	May 11 How to interpret results D or H	May 13 Prepare data for input
May 16 Presentation of results - I D	May 18 Present results - II D	May 20 Interpret results
May 23 Future applications implications etc H or D	May 25 Recap H or D	May 27 Make classification

10 Weeks 2 Lectures One long lab. or discussion per week

Lecture Number		Subject Speaker	Contents
1	Introduction	Dave	Purpose of course, how we got into this ourselves. (Anderson's Exp.)
3 2 4	Computers	Bob	Simple exposition of how they work, what they can and cannot do. Examples of uses. (Anthrop. 1st part)
5 6 7 8	Mathematical concepts fundamental to objective thinking and modeling	Me	Sets, arithemetic, logic. Definitions, unique determination, functions, and correspondences.
2	Review of the history problems and objectives of bio-class	Dave	What is classification for and what have others thought about it. (Davis & Heywood, 1st 4 chapters)
8	How do you describe plants	Hen	Coding and characters keys
9	and what can be done with the subscriptions	Dave	identification information preservation.
10	How do you measure similarity	Me	Discuss similarity measures
11	Problems biological with similarity	Dave Hen	How does similarity measure influence coding desicions. What problems arise.
12	Solutions	Me	How can math solve problems.
13	How should we define a	Dave-	Discuss various definitions
15	biological cluster.	Hen	
14	How can we use these definitions	Me	Discuss efforts on cluster analysis
15	Other measures and methods	Me	
16	The role of the machine in using the method	Bob	Preparation of data formats for printout, etc.
17		Dave	
18	Interpretation of results	Hen	Case studies.
19		Dave	
20	Presentation of results	Hen	Case studies, keys, diagrams.
21	Recaps	Dave	Restatements of objectives and attitudes

Labs and Discussions 10

1 Discussion of anything - D H B G plus class.

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Re-describe case study with a similarity measure in mind.

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62-1

- Taxonomy Laboratory

November 18, 1965

Dr. David B. Dunn
Department of Botany
University of Missouri
Columbia, Missouri

Dear Dave,

At the suggestion of Edgar Anderson, I am writing to request the loan of material representing the genus Uvularia in your herbarium to this department, and specifically to me. The reason for this request is that I would like to have a good, clear-cut genus to run as a test case for our computer methods. I recall that this particular genus has several fine examples of clear-cut species as well as good examples of introgressive hybridization. If all goes well, the need for this material will be completed in the next nine months. I will be happy to have any specimens you have.

Sincerely yours,

David J. Rogers
Professor of Botany

DJR/ec
CC - Dr. Harold Harrington, CSU, Dept. of Botany

P.S. I recently received a set of your reprints, and I am very appreciative of them.

File Copy

- Taxonomy Laboratory

November 18, 1965

Dr. Walter H. Lewis, Curator
The Missouri Botanical Garden
2315 Tower Grove Avenue
St. Louis, Missouri

Dear Dr. Lewis,

I have just received a letter from Dr. Anderson, saying that he is willing to let the material representative of the genus Uvularia go on loan. I would, therefore, like to put in a request for all the materials representing this genus to be made as a formal loan to the herbarium or to me at Colorado State University, Department of Botany and Plant Pathology.

It is my intention to use these specimens in a course which will be taught for the first time this year. I assure you that the material will be given absolutely first-rate care and will not be damaged during the procedures of the course. Please be assured that we will pay for the shipment both ways.

Sincerely yours,

David J. Rogers
Professor of Botany

DJR/ec
CC - Dr. Harold Harrington, CSU Dept. of Botany

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- Taxonomy Laboratory

November 5, 1965

Dr. Edgar Anderson
Missouri Botanical Garden
2315 Tower Grove Avenue
St. Louis, Missouri

Dear Andy,

This is a combination news letter and request. Although I am pretty sure I sent an announcement around to the effect that I had accepted a job as Professor of Botany here, I should probably tell you more details about the move and why.

We have been fairly successful in our investigations concerning the use of computers for assistance in the taxonomic process. I have had a number of classifications run on data supplied to me by other taxonomists, and the groups of organisms are as diverse as Actinomycetes to tropical legumes of the genus Cassia. Because of the way we have been working:(that is, hiring a professional mathematician to work directly with taxonomists and then hiring first-class programmers to work with the mathematician) we felt that it was necessary to get into a location where more active teaching was possible. Colorado State offered me the opportunity to fulfill this desire, so now I have a position here with three assistants -- another taxonomist, a mathematician and a programmer.

We intend to begin our teaching with techniques in classification because I have felt ever since my graduate days that this was one hole in the instruction usually given to taxonomists. When I say techniques in taxonomy, I mean discussions of such items as "What is a character and for what purposes are characters used?" "How does one use the information from a character in order to develop a classification?" "What rules do taxonomists use in putting together individuals into various taxa?" "How can one measure the distances and differences between taxa?" So, we are generating a course which I think is essentially new as far as teaching taxonomy to students is concerned, at least in the U.S. I had rejected the idea prevalent amongst taxonomists that you could not teach taxonomy -- you had to learn it. I may be wrong, but I feel that definitely taxonomy can have some of the aura of mystery removed from it and that its methodologies can be explained to students.

In the course, we will also tell the students that they must be extremely cautious in the selection of mathematical models to reflect their thinking. I don't think that this is a new idea. As a matter of fact, I can cite one of your publications to show that it is not new, but our procedures have adequately demonstrated what you said. We rejected the typical statistical methodology in favor of another type of mathematical approach. There are certain other approaches than the one we have, but at least we can point a direction for students.

One of the things that I want to do in our new course is to actually give the students a problem in classification which they can follow through from the development of characters to the actual process of classification. For this purpose, we need a group of plant materials of one genus where the problems are not necessarily too complicated. It occurred to me that the genus Uvularia would provide an excellent example. I recall our study of these plant materials under your direction when I was your student. I would like very much to use the same specimens for our purposes here, and would like to request the loan of these specimens from you. The specimens will be given extra care, and they will not be mistreated. Do you still have assembled the same materials for the genus Uvularia which we used fifteen years ago?

Our family is as might be expected well on the road towards maturity with the oldest daughter, Marilyn, now a freshman at the University here, son John is a sophmore in high school, and son Richard is a 5th grader. They all seem very pleased with the move and we are much happier here in Colorado than we ever were in New York. I hope things are going well for you and will be pleased to hear from you.

Very sincerely yours,

David J. Rogers
Professor of Botany

DJR/ec

NOV - 5 1965
62

OFFICE MEMO

TO: Dr. Fults

Date Nov. 4, 1965

FROM: D. Pettus - S & A Curriculum Committee

SUBJECT: B170 - Taximetrics

REMARKS:

At its meeting of November 1, 1965, the Science and Arts Curriculum Committee approved your request for the new course B170 - Taximetrics. The request will now be forwarded to the University Curriculum Committee.

DP/gs
cc: Dean Roy Nelson
Dr. Rodgers - Botany

10 copies to Stella M. Lewis, Secretary of the Curriculum Committee and the Graduate Council. 20 copies if graduate course.

REQUEST FOR NEW COURSE

I. List course number and title; quarter(s) offered; credits, lecture and laboratory distribution; prerequisites; instructor and his academic rank. (Follow the style of the University catalog. University regulations governing class hours per week for the quarter per credit: 1 hour of lecture per week = 1 credit; 2 hours of laboratory per week when outside preparation is required = 1 credit; 3 hours of laboratory per week with no outside preparation = 1 credit.

B 170 - Taximetrics 3(3-0)

Prerequisites:

B 23 or equivalent in Zoology or Microbiology and M15.

Development of biological and mathematical concepts for the processes of classification - Instructor, Professor Rogers

II. Course level: Undergraduate __; Undergraduate and Graduate X ; Graduate __.

III. If new course is to replace existing course, indicate the course number and title of course to be dropped: not a replacement ---.

IV. Names of department heads with whom proposed course has been discussed: Fults, Graybill, Olson (Zoology).

V. Prpsed text or source material for course: _____

VI. Attach topical outline of lectures, notto exceed 2 pages.
Attached to original proposal previously given to Dr. David Pettus.

APPROVAL RECOMMENDED:	Signature	Date
Instructor	David K. Rogers	Nov 2, 1965
Head of Department	Jesse Fults	11/2/65
Dean of College		
College Curriculum Comm.		

10 copies to Stella M. Lewis, Secretary of the Curriculum Committee and the Graduate Council. 20 copies if graduate course.

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B 170 - Taximetrics. EXED 3(3-0)

Prequisites:

~~B1, B2, B 23, or equivalent;~~ **B 23, or equivalent in Zoology, Microbiology, ~~or other department offering in Systematics;~~ College Algebra. ~~Consent of the instructor,~~ Professor Rogers.**

and M45

Development of biological and mathematical concepts for the processes of classification.

To Dr. David Pettus in Zoology Dept.

II. Course level: Undergraduate ___; Undergraduate & Graduate X; Graduate ___.

III. If new course is to replace existing course, indicate the course number and title of course to be dropped: ~~not a replacement~~ _____

IV. Names of department heads with whom proposed course has been discussed: **Pultz, Graybill, Olson (Zool.), ~~Wood (Botany), Daniels (Bot.)~~**

V. Proposed text or source material for course: _____

VI. Attach topical outline of lectures, not to exceed 2 pages.

APPROVAL RECOMMENDED:	Signature	Date
Instructor	_____	_____
Head of Department	_____	_____
Dean of College	_____	_____
College Curriculum Comm.	_____	_____