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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.

Lect. to B23 class, Dec. 2, 1965

### Taximetrics

Derivation of the name. Greek taxis = to arrange; and metric, to measure

"New" discipline not really new--one more dimension, the computer as a tool causes us to pause in our pursuit of over-all classification to discover our rules, procedures, etc.

This discussion, therefore, concerned with thinking processes in taxonomy, more than with plant material itself.

Previous lectures in this series oriented to kinds of data useful in taxonomy--Mr. Lane--pollen, Mr. Oshima--species in fungi, Mr. Klein--cytology & biosystematics, Mr. Ward--ecological data & taxonomy.

How are these data, or disciplines used in taxonomy.

Differences between floristic and monographic taxonomy--some problems not evident from your present study. Example--the genus Astragalus, milkvetch, has rather large representation in Colorado, with 76 listed species, but the monograph of this genus for North America lists about 360-380 species.

Historical development of taximetrics

Period 1957-58, covering just a little over a year, saw first computer use for taxonomy.

P.H.A. Sneath, in London, a bacteriologist

R. R. Sokal, at U. Kan., a statistician, working with an entomologist,

C. D. Michener.

D.J. Rogers, NYBG, a botanist, working with a mathematician, T. T. Tanimoto.

Though working separately, these 3 came up with computer programs whose basic ideas were remarkably similar, but whose methodologies were quite distinct.

Reasons for using computers in taxonomy

1. rapid computational ability
2. memory store
3. capable of doing exactly what is directed, no more, no less.
4. large number of unclassified plants and animals
5. taxonomy as an information-retrieval system
6. my own needs in classification of Manihot esculenta.

Problems

1. Most difficult is to decide exactly what is required (computer only does what the instructions say to do).
2. Since computers work with simple arithmetic procedures, must convert thinking process to mathematical expressions--what type math to use?
3. Development of whole new disciplines within math., made possible by computers.
4. Programming the computers
5. Biological interpretation of the results.

The flow of taxonomic endeavor--chart.

How to read the chart

How does one decide where a problem in classification occurs?

Areas in taxonomy where most computer work done--areas 3 & 4 of chart.

How does it work

1. similarity measure for all objects in the study
2. some technique by which these similarities used to put objects together in clusters.

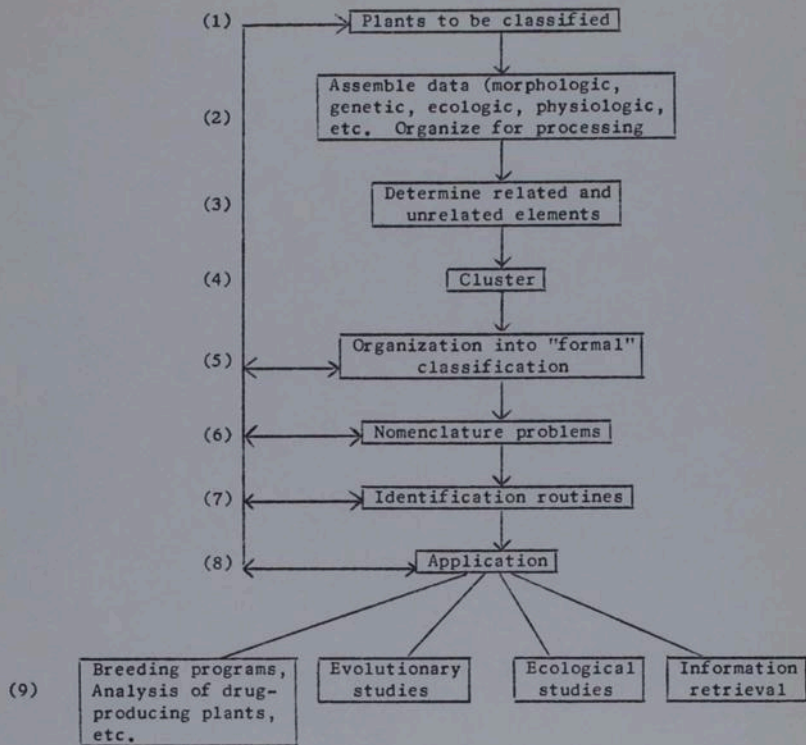
The problem for the taxonomist is: What do you mean by "similar"

When do you know you have a satisfactory cluster--

What will you call the formed clusters--species, a genus, a family.

When we can answer these questions, then we can think of using the computer.

PROCESSING TAXONOMIC PROBLEMS



David J. Rogers  
Professor of Botany  
December 2, 1965