

# ICN-5

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This special issue of ICN contains position papers associated with the upcoming Entomological Collections Network meetings to be held at Louisiana State University, Baton Rouge, November 30-December 1, 1990. We ask that each of you read the papers in advance of the meeting so that you can organize your thoughts and suggestions for the session. The meetings are organized around two broad themes and will attempt to focus on the following specific questions.

## National Agendas Discussion Topics

James S. Ashe, Douglass R. Miller and Scott E. Miller (Lead)

### How to gain strength from diversity:

Development of a matrix of small, medium, and large systematic institutions that will enhance the community's effectiveness and financial base.

### The interactions of systematic science and service:

Given the different missions of our institutions, how can we all work together toward common needs of U.S./International entomological systematics?

### Collections networks/cooperative resource utilization:

How can institutions cooperate in order to make the most effective use of available resources (including collections, data, people, funding opportunities)?

### The significant role of small systematic institutions:

What unique niches are available to small institutions (especially state collections) and how can these best be exploited?

## Automatic Data Processing for Systematic Entomology: Promise and Problems

Gerald R. Noonan, F. C. Thompson and Ronald A. Hellenthal (Lead)

### ADP philosophy, strategy and goals:

What are the goals we seek from ADP for systematic entomology? And, therefore, what is our strategy and philosophy? Who are our users (curators? scientists? students? the public?) and what are their needs?

### Data elements:

Where does systematic data come from (specimens, labels, literature)? What does it consist of (characters, names, associations [biological, ecological and geographical] and transactions [loans])? How can it be reduced to its basic elements (core fields)?

### Data structures:

What are the best ways to organize these data elements into more comprehensive units (records, files and databases)?

### Data standards:

With standards being essential for communications and sharing of information, which of the existing standards should entomology adopt for its needs and what new standards are needed?

Position papers for the "National Agendas" section are reproduced herein. Contributions associated with the "Computer" Section are contained in a separate report entitled "Automatic Data Processing for Systematic Entomology - Promises and Problems" by Ronald Hellenthal (Notre Dame), Jerry Louton (Smithsonian), Gerald Noonan (Milwaukee Public

Museum), Randall Schuh (American Museum of Natural History), Margaret Thayer (The Field Museum) and F. Christian Thompson (USDA).

We want to emphasize our appreciation to all those who contributed to ICN-5 on such short notice. George Venable was responsible for layout and graphics; Juanita Hall, Maureen Mello and Mary Jo Molineaux handled distribution ... many thanks to all!

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## National Agendas Discussion Topics

### How to Gain Strength from Diversity

### Cooperation: A Window of Opportunity for Entomological Systematics

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For systematics and more specifically entomological systematics, the 1990's should be a time of opportunity, growth, and significant scientific accomplishment. With the emergence of a definitive systematic theory, we now are able to propose hypotheses that are objectively defined, testable, and predictive. These results have broad implications not only on the science of systematics but also on nearly all other scientific disciplines. With this theoretical structure as a backdrop, and with public interest in environmental issues at its apogee, we must make

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Continued from page 1.

**ICN-5: A SPECIAL ISSUE**

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our relevance and impact on this issue understood. This requires that entomological systematics present itself as a unified discipline. It is crucial that the diversity of ideas and missions within our ranks be used to our overall advantage not disadvantage as so frequently is the current scenario. Clearly, the success of astronomy and high energy physics comes from the unified voice that these disciplines convey when communicating with funding agencies, Congress, and the press. Among themselves their interactions are as diverse and heated as in any other active field of science. ECN and ICN as forums, allow us the opportunity to incorporate the diverse facets of our discipline into a single overall goal and plan.

I believe that our long-term goal ought to be to make significant advances in the science of entomological systematics. The final products of this goal may take many forms but in most cases are exemplified by new theory or group revisions and monographs. To accomplish the goal of improved systematic science many diverse elements must be generated, analyzed, and synthesized. EACH of us plays an important role in making some or all of these elements available. For example, small museums may contribute by studying local faunas, generating local inventories, maintaining specimens from these studies, stimulating public interest and support, and perhaps by producing component research papers or select group revisions. Large museums contribute by producing many monographs and revisions based on elements generated not only by themselves but by all other organizations from the systematics structure. I could go on, but instead I have attempted to generate a matrix that summarized the missions of systematic organizations, this table attempts to show GENERALIZED functions as a basis for discussion. [See table 1.]

Some of us may lose sight of the significant role that institutions with very different missions play in

achieving the overall goal of improved systematic science. In certain cases, the contributions of organizations are far removed from the products of the goal and are considered unimportant by some. I suggest that this is not the case. All organizations that are contributing in a QUALITY manner are important to the future of systematic entomology. Identification services fit this scenario. I concur with those who wish to dispel the belief that identification services are synonymous with systematics. However, we should not remove this function from our agenda since it gives us a powerful advantage not shared with other disciplines. To give an overview of the interactions of various components that ultimately contribute to our goal, I provide the following PERT Chart. The many elements of the chart are intertwined in a startlingly complex manner. [See figure 1.]

In several of the position papers that follow you will see ideas that could lead to greatly enhanced productivity of the overall systematic community, and in each case will benefit the participating individuals and institutions also. Richard Brown's idea of an identification protocol that involves local institutions before going to a national center; Ron McGinley's idea concerning a network of institutions that will sort material and make it available for study; the computer group's suggestions of standards so that information will be more readily accessible and useful; Rob Brooks' idea (pers. comm.) that museums coordinate ordering materials so that large lot prices will be available to all; etc. It seems clear that each of us can benefit from cooperation. It is time for each of us to give support to those kinds of activities that are different from our own so that their contributions can be added to the overall entomological systematic plan. It now must be our goal to coordinate ourselves so that all will profit and our goal of improved systematic science will be achieved.



**Matrix of Missions of Systematic Organizations**

	National Collection	International Collection	State Collection	Local Collection	Specialized Collection	Local Ids	State Ids
Large Mus.	P	P	N	N	C	R	R
Small Mus.	N	R	P	P	C	P	C
Large Univ.	C	R	C	C	C	P	P
Small Univ.	C	N	C	C	C	P	P
Federal Org.	C	C	R	R	C	C	C
State Org.	R	R	P	C	R	C	P
Local Govt.	R	N	C	P	R	P	C

	National Ids	International Ids	Maintain Vouchers	Inventories U.S.	Inventories State	Inventories Tropics	Parochial Studies
Large Mus.	R	R	C	C	R	P	C
Small Mus.	C	R	C	R	C	R	P
Large Univ.	R	R	P	C	C	C	C
Small Univ.	R	N	C	C	C	R	C
Federal Org.	P	P	C	C	C	C	C
State Org.	C	R	P	R	P	R	P
Local Govt.	R	N	R	R	R	N	C

	Group Revisions	Small Papers	Small Service Papers	Public Outreach	Training of Students
Large Mus.	P	C	R	P	C
Small Mus.	C	C	C	P	R
Large Univ.	P	C	C	R	P
Small Univ.	P	C	C	R	P
Federal Org.	P	C	C	C	C
State Org.	R	C	P	R	R
Local Govt.	N	C	C	P	R

P = Primary  
 C = Common  
 R = Rarely  
 N = No

Table 1.

**Interactions**

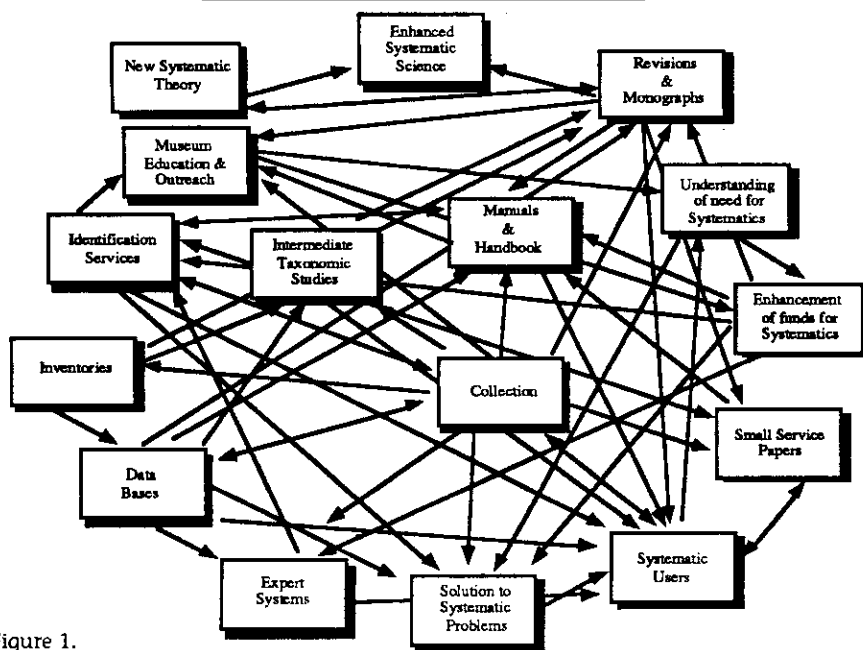


Figure 1.

**The Smaller State Land-Grant University Collection: A Key Player in Entomological Training, Research, and Service**

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The state land-grant university collections of all sizes variously can and do stand in an important position in entomological training, research, and public service in the United States. They provide (1) training for most of the professional staffs of the larger institutions, (2) systematics research resources for the fauna peculiar to their respective states, and (3) the principal clearinghouse for service identifications and entomological information.

**Training:** In the United States, undergraduate and graduate degrees in entomology are usually earned in departments of entomology (by

whatever name) at state land-grant universities, where most entomological training is centered. Consequently, most of the professional staffs in the larger insect systematics institutions obtained their degrees in these departments. For this reason, systematics students should obtain a strong training in collections management. Curricula for entomology degrees usually require some training in insect identification for all students, but rarely or only incidentally is training provided in either systematics theory or the role of insect collections. Because, future administrative and financial support by non-systematist graduates is of great importance to the long-term health of all bio-systematics collections, a critical part of a least graduate education for all students should be enlightenment on systematics theory and applications and the techniques and importance of collection management. Cooperation toward these ends can be achieved by at least the following:

Larger collections -

(1) Provide competitive collection enhancement funds for graduate students to conduct research, identification, and curation activities in your collection; give preference to students from institutions having smaller collections with less curatorial activity, students who can thus better profit from the experience.

(2) Present seminars at smaller land-grant universities to give a higher profile for modern systematics research and curatorial concerns, assisting in attracting students into the systematics and collections management fields and in broadening the perspectives of non-systematics students.

(3) Communicate frequently with colleagues at smaller collections to learn of outstanding systematics and collections management students nearing completion of degrees and preparing for entry into the full-time, professional job market.

Smaller, university collections -

(1) Initiate and keep current courses and seminars devoted to modern theories and methods of biological systematics and insect collections management and the many applications for these concepts and techniques in biological research and public service.

(2) Incorporate modern systematics and collections management ideas into other courses.

(3) Encourage and fund systematics students to travel to larger collections to meet other systematists and to become acquainted with curatorial practices in different institutions.

(4) Assume active oversight of loans to students from larger collections to assure care for the borrowed insect specimens and training in proper specimen management.

**Research:** The state collections provide unique systematics resources for the intensive study of the fauna of their respective regions. They are in the position of providing study materials for locally distributed species, including those that may be rare or endangered. Larger collections, on the other hand, can provide specimens and literature from many regions of the world in support of comprehensive revisions. Loans and exchanges of specimens, literature, identification expertise, and holdings information between smaller and larger collections will enhance the research efforts of systematists at institutions of all sizes. Cooperation can further be achieved at least in the following ways:

Larger collections -

(1) Maintain primary types of specimens described by systematists at smaller institutions.

(2) Provide reprints and other literature help for smaller collections whose science libraries are typically more limited.

Smaller collections -

(1) Help visiting scientists to find populations of local species and provide current information on the status of known populations.

(2) Assist in research on living natural populations, including determination of life histories, hosts, habitats, etc.

(3) Maintain voucher specimens of research conducted by colleagues and students at your institution.

**Public Service:** Land-grant university collections still handle most of the identification and information service work that is referred from the cooperative extension service in each state. They are clearinghouses for resolving identification or information needs that are too detailed for the resources of the collection. Negotiation of identification work with other systematists, often at larger institutions, is an important responsibility for land-grant university systematists. Cooperation in at least the following ways will improve the efficiency of the work:

Larger collections -

(1) Publicize your protocols (and fees?) for service work.

(2) Help assemble names, addresses, and specialties of insect systematists nationally.

Smaller collections -

(1) Determine how much detail each user really needs and discourage unnecessary workloads for cooperating systematists.

(2) Maintain collections and identification literature in such a way that service work can be accomplished effectively at the lowest level possible.



### Two Cooperative Success Stories in the General Biological Community

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In the late 1970s, the Pennsylvania Department of Natural Resources sought a better understanding of the status and viability of the plants, insects, fish, amphibians, reptiles, birds and mammals of the Commonwealth. Curators at the Carnegie Museum of Natural History were among the people called upon to produce a preliminary list of Species of Special Concern within respective disciplines. The resulting network of cooperative research, regionalized field work, and shared grant support that has developed in the field of mammalogy within the Commonwealth of Pennsylvania is a perfect example of the importance of interactions among colleagues with varied affiliations.

Mammals of Special Concern included species with populations that were considered threatened, endangered, and of undetermined status. The Pennsylvania Game Commission also played a part in the development of these designations. The Commission was subsequently able to use this information to guide its management policies as well as sales of hunting and trapping licenses. As an outgrowth of this preliminary work, the Pennsylvania Biological Survey was created. One subset, the Mammal Technical Committee, went about the business of learning more about mammals of undetermined status. The Committee includes a museum curator whose collection numbers over 100,000 specimens, a curator of a 16,500 specimen collection, a field station director, a staff member of the Western Pennsylvania Conservancy, a staff member of The Nature Conservancy, two Game Commission employees, and ten professors from both public and private colleges and universities

throughout the state whose interests include wildlife management, population biology, systematics, ecology, and behavior of mammals. Many of the professors maintain small teaching collections.

Among the species under active study at the present time is the Allegheny woodrat. This particular study is supported by a grant to the Mammal Technical Committee from the Commonwealth of Pennsylvania. These funds are derived from a taxpayer check-off system designated for the study of wildlife resources. Like other mammals in the status undetermined category, the woodrat is a secretive species whose historical presence in the Commonwealth is supported by museum specimens. Information on current distribution and nesting sites is developed using old locality records as well as reports to and by Conservancy staff; Game Commission personnel whose field assignments make them especially familiar with regions of the state; and university professors who lead classes into the field and recognize appropriate habitat. Contact with game personnel and academic colleagues in adjoining states also has been helpful in assessing overall population trends for this species.

Whereas bird researchers can utilize the network of amateur and professional bird enthusiasts as a springboard to studying the status of a species, no such organized and sizeable body exists to aid in similar studies of mammals. Mammals are not usually brightly-colored, many are quite small, have hidden nests, and are nocturnal. A network of observers is essential for thorough study of the woodrat and other species. Yet fifteen years ago the individual components represented by the members of the Mammal Technical Committee visualized their interest in mammals as unique within the Commonwealth. Perhaps no one knew enough about what the others did for a living to realize that the hours spent patrolling a region, or leading students on a habitat survey, or researching land for protective acquisition, could gel into

fruitful, on-going cooperative research.

A similar but even more impressive network of new affiliations has developed with the birth of the Society for the Preservation of Natural History Collections (SPNHC). This organization was created at the conclusion of a workshop on collection care in 1985. The workshop was attended by about 50 people.

The organization has grown to a membership of over 500, produces a semi-annual peer-reviewed journal, and a semi-annual newsletter. Individual members include curators, collection managers, curatorial assistants, exhibit designers, museum educators, directors, museum and private conservators, and scientific preparators, and private taxidermists. SPNHC members are involved with the care and management of botany, zoology, anthropology, geology, and paleontology collections all over the world. Art museums and anthropology collections have focused attention on conservation for many years. The need for natural history conservation, and research on collection care topics is among the foremost interests of this group.

Instead of finding that the diversity of discipline divides the group, members have discovered innovative methods of collection care from each other. Workshops on computerization, storage design, pest management, environmental hazards for museum specimens, health hazards in the museum setting, sources of funding, and loans and accession policies are topics of interest no matter the size of one's collection. A workshop at the most recent Annual Meeting dealt with suppliers of products used in many types of collections. As a result, attendees have developed a series of contacts with addresses, price lists, specifications for archival-quality materials, and a whole range of information that would have been tremendously time-consuming for a single individual to devise.

Presentations that discussed the importance of various museum stor-

age case features were attended by many museum professionals as well as representatives from three case manufacturers. Since then, several companies that build museum storage cases have been quite responsive to requests for design changes.

Care of fluid-preserved specimens is something that is of great interest to several life science disciplines. Research data on long-term preservation of reptile, amphibian, and fish collections has been especially interesting to mammal collection personnel. Questions on limiting alcohol evaporations, reliable suppliers of specimen jars with good seals, the effects of using different types of alcohol and different percentages of alcohol, and proper conversion from formalin are all things that are dealt with on a much greater scale by ich and herp people than by mammal caretakers.

The cost of "re-inventing the wheel" cannot be overstated. It seems quite clear that the continued interactions of so many people can save each other a lot of effort, can save their museums considerable money as a result, and could help save millions of museum specimens for many more generations.

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## The Interactions of Systematic Science and Service

### The Interactions of Systematic Science and Service

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I can best address this important issue by citing examples of my past year's activity. The absence of an identification service for leafhoppers at the federal level (USDA) has drastically increased the number of requests for identification assistance

by researchers studying Auchenorrhyncha. It is difficult to refuse these requests since good research efforts in any discipline must be based on correct identification of the insects involved. Researchers, in my opinion, deserve competent systematic assistance. However, teaching responsibilities and a commitment to systematic research places constraints on my time. I am forced to be selective and to begin assessing a fee for identification projects that I accept. These projects include:

1. A graduate student in California studying the diet of high flying swifts in Mexico, sent Homoptera that were removed practically intact from the crops of these birds. I was intrigued with the project and found two new taxa resulting in a research paper. A colleague also found new taxa and another paper resulted. What a novel method of collecting insects!

2. A researcher in Texas needed identification of leafhoppers associated with sugar cane. I found several records of insects that I am presently studying and designated several possible vectors of disease in sugar cane.

3. The graduate student of a colleague requested identification of a leafhopper from Mexico associated with *Tripsacum* and its relatives. It was a new genus and species that is presently being tested to determine if it is a possible disease vector; a joint paper has been submitted.

4. A colleague from the British Museum sent a unique specimen for identification, resulting in a joint paper addressing the subfamily status of a poorly known genus in South America. A paper is in press.

5. A colleague in New Mexico studying possible biological control of snakeweed by insects requested the identification of the numerous leafhoppers collected on this host. I found a number of records for species presently being studied and we have tentatively begun a collaborative project. He spent several days in my laboratory learning preparation and identification techniques so that his staff can handle routine identification and I will have

to be consulted in the future only when he has problems. This will help.

As entomological researchers continue to need identifications in the future, they are going to have to support systematic efforts by including service dollars in each grant proposal submitted. If I had a full-time technician to handle specimen preparation and routine identification, I could accept requests for identification from many established research programs as well as establish many collaborative efforts. Routine identification is generally a drudgery; but accurate identifications must be supervised by a systematist. My recent systematic efforts have been collaborative, including a colleague who investigates the biogeography and ecology of leafhoppers in arid grasslands and presently including a geneticist. This has been a good approach and these collaborations have improved my systematic efforts.

Another collaborative area is the deposition of voucher material. Many scientific journals have begun requiring a statement on the location of these specimens. All journals should do this. It adds another task for the already overburdened systematist who is also usually poorly funded. Here is another striking example of the need to include funding for systematic support in every research project, regardless of its source of funding, or an overall increased amount of support from a central source within every institution.

Lastly, the erosion of support for systematics is appalling. The entire entomological community must, in my opinion, determine the kind of systematic support it needs and demand it from the appropriate administrator.

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### Science and Service in Insect Systematics

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"If in this struggle for survival biological systematics has recently lost ground to other and, as if often heard, younger and more modern disciplines, this is not so much because of the limited practical or theoretical importance of systematics as because systematists have not correctly understood how to present its importance in the general field of biology, and to establish a unified system of instruction in its problems, tasks, and methods." W. Hennig, 1966, p. 1

The practical and theoretical importance of systematics discussed by Hennig (above) mirror the service and basic scientific strengths of contemporary systematics. It seems fairly obvious that both the practical and theoretical aspects of systematics are of critical importance and that these two general goals may be pursued in an integrated fashion by individual researchers and institutions, or achieved collectively by the systematics community through more specialized efforts by individuals or single institutions. Thus, rather than exchange accolades for the mutually important activities of practitioners and theoreticians, I would prefer to address a more fundamental problem that currently threatens systematics as a whole and therefore the good deeds of each.

We may ask, given recent decline in numbers of Ph.D. students trained, proportion of research dollars garnered, and hiring trends (especially in universities), if any single problem can be identified for which a solution, if found, would hold promise for improved opportunities. I believe that such a problem, and its solution, exist and are deceptively simple. Admittedly, there are many specific problems plaguing systematics at the moment, but most could be mitigated if not removed were we

to succeed in the area discussed below. I would characterize this specter as an **identity crisis**. Not so much within the discipline, though this is true to a lesser extent, as outside it. We are widely perceived in one or more inaccurate ways. These false impressions are shared not only by the public at large and science in general, but equally so by professional biologists. Herein lies our greatest problem and challenge. There are those whose narrow understanding of science clouds their vision of the nature of the historical endeavors and of phylogenetic reconstruction in particular. There are those who believe that systematics is something of a cross between biophilately and identification service. And there are those who confuse what Hennig referred to as tokogeny and phylogeny, and thereby confound problems of population biology with those of systematics proper.

If our principal problem is how we are perceived, then the solution must lie in how we educate fellow biologists about what systematics is, what its goals are, and why it is both important and exciting. Additionally, this will entail demonstrating how it is indeed a rigorous and independent science, and what its appropriate role is in biology and the mounting biodiversity crisis.

The unified message from systematics ought to be, in my opinion, more or less as follows. Systematics is a science. This is based on the nature of the hypotheses we create, and the fact that they are open to critical testing and potential refutation. Systematics is the study of species diversity; of the recognition of species, and of (phylogenetic) studies of the relationships among them. The goals of systematics are diverse, but primary among them are the following: (1) discovery of phylogenetic patterns of relationship; (2) development of theories and methods appropriate to this goal; (3) monography, revisional taxonomy, cladistic classifications, and accurate and detailed descriptions of species and of monophyletic groups of species; (4) an inventory of species and

monophyletic groups of species. While the successful recognition of species requires knowledge of infra-specific variation, genetics, and to-kogenetic patterns, it remains true that the focus of systematics is at and above the level of species. Where the focal questions deal specifically with populations or subspecies, it is a problem in population biology and not systematics. Our descriptive charge includes discovering how many species there are, describing them, analyzing their relationships, and classifying them according to our conclusions (hypotheses). This goal, of course, has never been more timely nor challenging than it is and will be for the next few decades (Wilson 1985, Wheeler 1990).

While descriptive and identification work are central to taxonomy, and are as much a basis for phylogenetic studies as for biology in general, I regard them as the data-gathering phase of taxonomy. The primary goal, in my opinion, is conceptual and is ultimately expressed in cladistic hypotheses and cladistic (or natural) classifications. Both of these general contributions - descriptive/identification and phylogenetic - are absolutely essential to biology as a whole. Without accurate identification of species, no credible biological research of any kind is possible. This is well known, and thought by some sufficient justification for systematics. While I do not disagree that this alone is fully worthy of biology's support, it has the disadvantage of making a rigorous science look exclusively like a service, and in practice it simply does not work. An analogous situation is provided by research library collections. I know no scientist or scholar who would question the importance of a complete library, and yet I know of no library that is given a budget adequate to this task. What we must do above all is to make known to biologists of every kind that studies of evolutionary processes and mechanisms can only be completed credibly when first given the underlying evolutionary pattern. And that only systematic biol-

ogy has the theories, methods, and raw data necessary to provide such patterns. We may point further to the fact that virtually every aspect of biology is increasingly viewed from an evolutionary perspective. IPM requires knowledge of relationships between parasitoids and hosts that are, ultimately, only fully understood against phylogeny. Behavior and ecology requires interpretations of the evolution of particular systems and of their possible adaptive or functional significance and these too can only be critically studied given a phylogeny. Similarly, every aspect of biology that seeks to be either truly comparative or evolutionary must ultimately rest upon an understanding of phylogenetic history.

While taxonomy might enjoy short-term successes by pinning its existence on its critically important service role to other branches of applied or basic biology, I believe that such a tactic would meet ultimately with failure. Changing priorities in allied disciplines, whether it be agriculture or ecology, would just as surely drift from taxonomic support as they have this century. Instead, basing systematics on its intrinsic strengths will keep it in good stead as an independent science in charge of its own agenda. These strengths, of course, are its theoretical product (the conceptual phylogenetic, or historical, framework and concomitant predictive classifications) and its numerous practical ones (including identification services). All sciences are weighted in accord with their relevance to science in general. Because of the central role of evolution in biology as a science, and the phylogenetic framework necessary to study evolution, systematics is assured a central and favored status in biology. Its success is further assured because of its ability to inventory, describe, and make possible accurate identifications of species and groups of them. I suggest, however, that we will regain the appropriate central position for systematics - and necessary levels of support - the identity of systematics is clearly established as the scientific study of species diversity (i.e., of the elements

of phylogeny, and their relationships).

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#### A State Perspective on the Interaction of Science and Service

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Before considering any aspects of the relationship between Systematic Science and Service Organizations

(those organizations, usually governmental, that provide identifications for other disciplines in science, industry and for the general public), it would be well to consider the organisms which are the concern of these organizations. Whether of the animal or plant kingdom, or of the mysterious world of viruses or similar entities, biological organisms are being moved around the globe at an alarming and ever increasing pace. The speed and efficiency of modern transportation has aided movement of people and goods, which in turn has increased the frequency of establishment of new and often destructive organisms into new areas. New introductions often mean the spread of disease and pestilence, not only for man and his associated crops and livestock, but just as importantly for the total environment as well. It is in the area of exotic pest problems that the above two organizations are most likely to interact, although the Service Organization Scientist relies heavily on the work published by the Research Scientist without necessarily making personal contacts.

While systematic research positions are being allowed to lapse due to attrition or are being cut outright, it must be emphasized again and again that the problems involving exotic or mis-placed organisms are increasing, not decreasing, and they will continue to increase for a very long time. Both Research Organizations and Identification Services are necessary steps in solving those problems which develop as a result of exotic pest introductions.

New introductions continually challenge the Service Organizations, whose responsibilities generally require identifications not only of the exotics, but of the local native and endemic organisms as well. Scientists at the Service Organizations are usually required to provide accurate determinations within several hours to several days, and usually are required to supply any available biological and economic information, as well as prognosis of biotic potential and economic hazard that

an organism may demonstrate in its new surroundings. The achievement of these requirements would not be possible without a solid liaison between scientists at the Service Organization and the appropriate specialist at the Systematic Research Centers. It would also not be possible without the availability of reference collections and literature, which in the best of situations are enhanced with the help of the Research Scientist.

However, with the increasingly complex dispersal patterns now being seen in the World's organisms and in the total numbers of taxa represented, Systematic Research Specialists are not always available to help with many taxa. As a result, in order to find answers to pressing local taxonomic problems, the Service Organization Scientist must often perform the research necessary to find the solutions. The research gets done, but funding for publications may then become a problem, or other factors such as work load or non-related work requirements may prevent the facts developed by this research from reaching the rest of the scientific community. This is a two way street, and the Research Scientist probably has funding problems as well, or worse, as we have already seen, his actual position may be in jeopardy. Funding must necessarily come from within the research organization itself, or from funds provided by industry or benefactor organizations. Any payment for identification services rendered by either organization are far from adequate to meet research and publication costs. Grants and aid from benefactor organizations are subject to considerable competition among the scientific community, and to make a systematic research project appear worthy of aid often would require more time or expertise than the researcher may have or more than the project really requires to be a useful scientific contribution.

Since the requirements for entry level as a Service Organization Scientist have gradually increased over the last few years, their expertise has greatly expanded, and

since Directors of these organizations are recognizing the need for research at this level, it should therefore be apparent that the Service Organization does in fact have a very deep array of talent and expertise, (i.e. systematics in general, knowledge of chemical identification techniques ranging from electrophoresis to serology, knowledge of morphometrics, expertise in computer techniques, publishing and illustration techniques and so on). These are valuable resources that can be used by and shared with the Research Scientist.

It may be that co-authorship, sharing of techniques, expertise and labor may be the only way for scientists in all systematic positions to attract grant money for many of the worthwhile projects that really need to be done. It may be the only way to solve many of the current problems in Systematics, funded or not.



#### Biosystematic Research and Services in Entomology

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#### Research

- biosystematic research involves the posing and testing of hypotheses to permit recognition of species, and construction of classification based on natural, monophyletic taxa.
- the biosystematic information base for the vast majority of insect and arachnid families comprises an incomplete inventory of extant species and inadequate knowledge of many species that are described and named.
- successive biosystematic treatments add new species, contribute new data on known species, and may include analysis of previously unused characters and reinterpretation of characters already used.
- the resulting improvements in

knowledge necessitate modification of species concepts, revision of classifications, and nomenclatorial changes.

- the biosystematic information base for many groups of arthropods is inherently unstable, and will continue to be so until most extant species are taken into account and analyzed in a phylogenetic context.
- biosystematic information is the output of a process of scientific discovery aimed at explaining how observed diversity came about, and understanding how evolutionary histories influenced distributions and, ultimately, community structure.

#### Application.

- meaningful research on biological problems cannot be planned or carried out until the species of organisms involved are described, named and classified.
- many ecological problems, especially those related to environmental changes, cannot even be recognized until systematic research provides baseline information on species which are the fundamental components of communities.
- taxonomic names serve as the key words for accessing biological information.
- many professional ecologists and economic entomologists are unable to identify insects and arachnids and cannot use classifications as information bases to enrich their research.
- the few remaining professional systematists are inundated with requests for biosystematic information on the identity, classification and distribution of species.
- the validity of the information base that supports this capability depends upon the quality of the research effort that generates the information.

#### The Current Problem.

- universities and government research institutions have been progressively phasing out systematics

programs in favor of more glamorous and adventurous areas of research.

- the current trend of reduced support for systematics threatens to permanently impair the knowledge base in entomology and related fields by destroying the continuity of research efforts and undermining the development and care of essential collections and libraries.
- politicians, granting agencies and managers are demanding that systematists concentrate on direct support for applied research programs relating to short-term, high visibility issues affecting special economic interests.
- client groups and managers have come to regard biosystematics as a reactive service rather than a proactive scientific discipline.
- current estimates suggest that there are at least 250,000 species of arthropods living in North America, and that fewer than half of them have been named, described and classified.
- progress toward understanding the composition, historical development, and basic ecology of arthropod communities in North America has been severely curtailed.
- issues such as environmental degradation, depletion of biological diversity and global climatic change are challenging North Americans to devise new approaches that promote sustainable use of resources.
- our ability to understand ecosystems, and to develop the capability to manipulate them intelligently, will depend largely on the level of commitment to improving the biosystematic information base on insects and their arthropod relatives.

**Solutions.**

- biologists must understand that biosystematics should be managed and supported as a basic science the must progress in advance of logically dependent disciplines such as ecology and biotechnology.
- universities must revitalize and strengthen the education of all biol-

ogists, and specially ecologists, by maintaining or reintroducing a solid, well rounded program including exposure to modern concepts, methods, and applications of biosystematics.

- biosystematists must learn to use modern technology to establish automated, interactive data bases that promote direct access to biosystematic information, inexpensively, and on a self-serve basis.
- biosystematists must cooperate effectively at national and international levels to ensure that resources are used efficiently in support of research and information systems.
- the public, politicians, and science managers must recognize biosystematic research in entomology and related fields as a strategic scientific discipline that requires secure, long-term investment of human and financial resources.



**Collections Networks/  
Cooperative Resource  
Utilization**

**Current Status of Collections  
Resources**

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In October 1988, the Association of Systematics Collections held a workshop in Washington, DC to discuss "Collections resources for the 1990's." It brought together 70 persons representing institutions of all sizes and types of governance for an evaluation of progress in the previous 10 years, and the directions expected in the next decade. Preparation for the workshop included a survey of United States and Canadian systematics collections, including questions on quantity and quality of collections, staffs, budgets,

and facilities over the preceding 10 years. A detailed summary of the entomological collections data is being published in *American Entomologist*, and is abstracted here.

A total of 46 institutional entomological collections responded, reporting a total of 155 million processed specimens in 1986. Twenty seven collections were university collections, although only two university collections were in the largest ten. The 46 collections loaned a total of almost 550,000 specimens in 1986, 75% of which came from the ten largest collections.

Collections administrators listed the most significant needs and priorities for development of their entomological collections as (not listed in prioritized order): **Curatorial assistance**, for both regular collections care and to deal with increasing problems of orphaned collections; **Databasing**, including basic cataloging of taxonomic names, lags far behind other disciplines; **Training centers** which offer both museum experience and modern systematics training are painfully few; **Space and storage facilities** present major problems for growing collections; **Material conservation** needs require much greater attention (Hoyer's slide mounting medium is a special problem); **Core funding is lacking** at many collections (many university collection had less than one FTE in staff and less than \$2000 in annual operating budget); **Raw numbers of specimens** have limited information content, while **inventories** such as the seven level system designed by the Smithsonian Entomology Collections Committee allow detailed tabulation of curatorial status of entire collections (forming a powerful collections and personnel management tool); and, the increasing pressures and opportunities of orphaned collection, biological diversity surveys, etc. mean that the entomological systematics community must find ways to efficiently use available resources, especially through **coordination and specialization**.

**Cooperative Resource Utilization**

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Entomological collections are at a crossroads, with the choices made over the next decade or two having far-reaching consequences. Never before have curators dealt with the enormous numbers of specimens that are being collected. Prior to the 1950's, specimens were collected in numbers that could be processed comfortably. Blacklighting, improved Malaise trap designs, and flight intercept devices have overwhelmed us with specimens. Now, on top of this, there is the threatened disappearance of large parts of the biota. How can we efficiently deal with vast numbers of specimens and adequately document diversity for both ourselves and our successors?

Shrinking financial support for collections, the aforementioned numbers of specimens, and the advent of new systematic methodologies are causing reappraisals of the objectives of systematic collections. Are masses of specimens to be uncritically accumulated simply because "they are there?" Decidedly not, as even the major institutions cannot deal with a catholic acquisition program, or even maintain a staff that can deal with most major taxa. The Natural History Museum's woes made it the first to receive general attention but it will certainly not be the last. There is a dawning awareness that new and innovative means of cooperation between collections must be explored, specifically with regard to curation, processing, and acquisition.

My perspective is rather different from that of the curator of a typical collection. The American Entomological Institute is the only sizeable private collection of which I'm aware. It is dedicated to one order, Hymenoptera. The major holdings are Ichneumonoidea (750,000) and Aculeata (98,000), with miscellaneous families bringing the total holdings to 1 million specimens. By concentrating on such a "limit-

ed" goal, the Institute has built up an outstanding research collection which is widely utilized. Nevertheless, it shares certain problems common to all collections.

One problem is that no single institution has the expertise to handle all taxa, let alone the major ones, either in the way of existing collections or incoming material. My own group, Ichneumonidae, provides an example. Ichneumonids are an abundant group of Hymenoptera (80-100,000 species), with only eight specialists in the United States and only two of those employed as curators at large ichneumonid collection (American Entomological Institute and Canadian National Collection, Ottawa). The Smithsonian Institution ichneumonid collection is the fourth largest in the world (250,000 specimens) but neither USDA nor the Smithsonian funds a position.

Curation is at a standstill. Yet material continues to pour in. At this time, only three unsatisfactory options are left to the Smithsonian: 1) mount nothing, 2) mount everything, 3) rely upon non-specialists to pick out selected specimens for mounting. Option 1 is the one in operation. For an abundant and speciose group, it is simply not feasible to mount all specimens, as this eats up resources that could be better spent for quality curation of other taxa and results in a great deal of non-essential specimens (common species and duplicates) getting into the collection. This situation is widespread. Even at the American Entomological Institute, we are not equipped to adequately process "Microhymenoptera" (Chalcidoidea, Proctotrupeoidea, Cynipoidea). Mechanisms exist, however, with the potential to solve or alleviate our problems: sorting centers, institutional specialization, cooperative networks, and loans of collections.

The idea of sorting centers and institutional specialization was discussed at length by Robert Wharton (1989, *Insect Collection News* 2 (1):6-7). Briefly, he proposed setting up at least one sorting center for ter-

restrial invertebrates modeled after the Smithsonian's Oceanographic Sorting Center. Bulk samples would be sorted to various levels and distributed to specialists worldwide. Concerning specialization, an institution could choose to concentrate on a regional or taxon basis, depending on a number of factors. Museums can compete for funding as national or international centers of excellence. These ideas, as Wharton succinctly phrases it, "are hardly new ideas, but rather ideas whose time has come."

Curators have often provided unmounted specimens to colleagues, with few or no strings attached regarding return of processed material. The frequency and scope of these arrangements has grown of late, especially at certain institutions. While agreements of this nature have not had obvious detrimental effects, objections can be raised. In a recent issue of *Insect Collection News*, (1989, 2(2):13-15), Chris Darling gave a very thoughtful discussion of potential pitfalls. They are: 1) compromise of the long-term goals of an institution for the benefit of individual research programs; 2) growth of all collections at about the same rate, benefiting larger collections at the expense of small collections and those with a large number of curators ("the rich get richer"); 3) splitting and dispersal of series, making subsequent revisionary studies more difficult; 4) thwarting collecting agreements that have been negotiated with foreign governments. Darling's first pitfall might be amplified in that quality hires might be compromised in the future if too much material is given away.

These are all excellent points. Darling suggested that rough-sort specimens be sent to the specialist, who would eventually retain a synoptic collection, but the bulk of the material would be returned to the collection or origin. This, however, still calls for a large expenditure of effort in getting rough sorting accomplished. A certain amount of altruism is needed as well, in that the goal should be to get specimens available for scientific research. If

another institution has a superior collection of a particular group or region, the bulk of the collection should go there if research is better served.

These problems were discussed during recent discussions between the American Entomological Institute and the Smithsonian's Department of Entomology. The two organizations are about to enter into a **specimen processing agreement**, with the Smithsonian sending unmounted ichneumonoids in alcohol to the Institute, where selected ichneumonid specimens are mounted, labeled, and sorted to morpho-species. The sorted series will be divided between the two institutions (odd numbers and single specimens will go back to the Smithsonian). Holotypes described from material retained by the Institute will be returned to the Smithsonian. A formal agreement will be signed, with both parties stating their mutual obligations. Specimens collected in foreign countries under obligations to return a certain percentage of processed material will be under separate agreements. Processed specimens will be provided with "restriction labels," which are separate colored labels that reference discrete numbers associated with the agreement(s). This will facilitate the return of primary type material, reunification of split series, and help insure that agreements/convenios between the Smithsonian and other countries will be upheld. Finally, the terms of the agreement will be made known to potential borrowers, and through notices in appropriate publications. This includes periodic advertisement of the various lots that are being processed. I believe that the simple expedients of formal agreements and restriction labels will take care of most problems discussed by Darling. While there might be objections that the Smithsonian will not get the bulk of the material, it can be pointed out that all species (plus holotypes) sorted out from this material will be represented in the Smithsonian. The alternative is that nothing will be done and the specimens remain in alcoholic storage.

The transfer of part of a collection between institutions, on a loan basis, is rarely done. But with the goal of enhancing research on a "dead" or underutilized collection, this would appear to be a reasonable action. As with the specimen processing agreement discussed above, the key concept is a formal agreement between both parties with the mutual goal of enhancing utilizing of the collection by the research community. The Smithsonian Department of Entomology has entered into two such arrangements (formally known as Offsite Collection Enhancement Programs), sending the collection of Bombyliidae to the Bishop Museum and the tick collection to Georgia Southern College. A third loan is being contemplated with the American Entomological Institute for the Smithsonian Ichneumonidae collection. In each case, a collection that was undercurated and unavailable to the research community is to be upgraded and enhanced. Briefly, the terms of the loan stipulate that: 1) a synoptic collection is to be returned to the Smithsonian at the end of one year, 2) the Smithsonian will provide drawers and unit trays to properly house additions to the collection, 3) all specimen loan transactions will be handled by the recipient institution, 4) the loan will be widely advertised in the entomological community, 5) the recipient will add new synoptic material to the Smithsonian collection, and 6) upon termination of the loan, the recipient institution may retain a synoptic set of specimens not represented in its collection (see McGinley and Evenhuis, ICN-4 for complete Memorandum of Understanding). Such loans entail much work and preparation, as well as certain costs. Only a relative few would be made for those groups in which circumstances have conspired to halt curatorial and research progress. They do provide, however, another way of dealing with too many specimens and too few specialists.

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### Collection Development and the Establishment of a Database of Retired Entomologists

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Systematic collections perform two principal functions, serving as depositories of voucher specimens and also as essential databases for present and future systematic studies. Both functions are vital in any serious attempt to address current questions related to biological diversity and conservation, as well as others of either a pure or an applied nature.

Collection-oriented work is labour intensive and the success and efficiency with which a museum performs its functions are directly related to the level of available manpower and expertise. Larger or smaller parts of all collections often suffer through lack of these resources, suffering not only physically but also scientifically. Classifications and indexes become outdated and obsolete, data retrieval becomes more difficult, until in time the collection is ignored or overlooked by outside workers. The data embodied within its specimens remain hidden and unavailable and unidentified material remains unworked. Such collections become backwaters to the mainstream of taxonomic advance and slowly diminish in value, importance and stature.

Management and development problems of this kind are becoming more prevalent today as we enter a period of escalating costs and contracting budgets. At a time when the community is showing increasing interest and activity in the fields of biodiversity and conservation, with consequent increase in specimen handling and storage requirements, we find ourselves with fewer rather than more resources with which to tackle the problem. Posts remain unfilled through lack of funds, or are diverted to other disciplines. Areas of a collection are closed down or put

on a care and maintenance basis only and slowly but surely the affected parts find themselves caught in the downward spiral.

How best can institutes avoid this dilemma, a dilemma that besets most systematic collections today, large and small, totally or in part? Given that a sudden increase in funds is an unlikely event in most cases, and that the necessary taxonomic expertise is an equally rare commodity, we must explore more efficient ways of utilizing those few resources which are available.

One of the major items of expenditure in the day-to-day running of most museums is staff costs which, in the case of a large museum, can account for more than 90% of the annual budget. Any attempt to increase staffing levels would only add to these costs and would be likely to fail through lack of long term funds. An alternative, however, is to engage outside expertise on short term appointments. Such expertise can be targeted at a specific area of the collection, for a specified task, and for a specified period dependent upon the funds available at the time. The institute retains maximum flexibility and control over expenditure by engaging only those services it can afford, at the time it is wanted, and avoids a more permanent commitment. The avoidance of the massive overhead costs associated with tenured staff means work at half the price or twice the work for the same money, depending upon one's viewpoint. Either way, productivity per dollar is considerably increased. Small sums of money, insufficient to engage additional members of staff, can be used to maximum effect. Such a scheme is particularly attractive for recently retired senior staff, and brings world-wide reputations and expertise to an institute. Without the need for the usual training period, they are effective and productive immediately, further increasing value for money.

Such a scheme has already been adopted on a small scale by some of the major museums. The present purpose is to draw attention to its

advantages in the hope that more widespread adoption would serve to benefit systematic collections nationwide. There is no substitute for permanent staff and the scheme is not being advocated as such. It is offered only as a means to overcome those collection problems that would otherwise remain insoluble.

A database of available expertise is currently being prepared by the author. Those systematists, recently retired or otherwise, who would like to be included are invited to write to the author giving their name, address, telephone/fax/bitnet number, animal/plant group and specialist area, and period of availability. The database will be available to all collection managers who would then be able to negotiate direct with specialists of their choice. Information on specialists' visits could be rapidly disseminated between museums via existing e-mail computer networks thereby enabling additional contacts to be established and included in a specialist's itinerary. This would be of particular value in the case of overseas specialists and others travelling long distances. Co-ordination of this kind, with the ASC or other agency acting perhaps as the nerve centre, would introduce further economies into the system. Of equal if not greater importance, such co-ordination will enhance and encourage the view of systematics as a single major national resource rather than a number of relatively small, separate and disparate collections.



#### Collection Resource Cooperation

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In a recent draft document concerned with the development of departmental specimen processing protocols, Terry Erwin, Chairman of the NMNH Entomology Collections Committee, wrote ... "Insects and their relatives constitute most of the

biodiversity of this planet. For example, one tree canopy in the Peruvian Amazon can have more than 50 species of ants and 1000 species of beetles, with a total arthropod fauna of as many as 100,000 individuals at any one moment in time. Sampling such trees and other various terrestrial ecosystem for the insect and arachnid portion of biodiversity is not difficult, but there is a tremendous bottleneck between collecting specimens in the field and studying them in the laboratory. This bottleneck is the preparation and sorting of specimen lots into taxon units and subsequent distribution of these to appropriate taxonomists throughout the systematics community." Terry goes on to say ... "For a number of years, it has been recognized that a depauperate technical staff at any given museum cannot process the massive numbers of entomological specimens that are collected by sophisticated trapping methods, especially in the tropics where each specimen may represent a different species and must be checked by a taxon specialist." How can we resolve this specimen bottleneck? The all too obvious answer is to hire more entomologists and support staff. However, I have seen this as the "solution" of choice for the last 20 years and have seen little growth in entomological staffing levels. Kosztarab and Schaefer (1990), with reference to the potential survey of the North American insect fauna, write ... "For the estimated 1,050,000 new descriptions and illustrations, we will have to employ at least 525 scientists and 525 illustrators for a period of ten years, or longer if fewer persons are employed ... with an average yearly salary of \$40,000 per person, this will cost, minimally, \$42 million per year." I agree we need to get more money to hire more people. However, I think we need to exercise caution in how we present arguments for increased funding. Donald Duckworth (Director, Bishop Museum) once told me "I don't hire managers to tell me they need more money, that is understood." While we all want and need more money,

the bottom line is how to effectively argue this case and get results. We must document all the significant things being accomplished based on current levels of funding, define future goals, and clarify procedures to realize these objectives. Most importantly, protocols to enhance efficiency and cooperation must be tested and implemented. So much of what we can do with regard to collection management should be viewed as an ongoing experiment. I find it ironic that this experimental/innovative approach to collection management is so limited and actually opposed by our community of scientists.

To address the challenges presented above, NMNH Entomology at the Smithsonian Institution (SI, SEL/USDA, WRBU/DOD) and cooperating organizations are attempting to 1) enhance communication, 2) develop means to more efficiently manage and utilize existing collections, and 3) develop protocols to contend with the specimen processing problems identified above.

#### PROBLEM 1: Communication

In order to increase cooperation we need to promote effective communication. This takes time and a bit of altruism. Dug Miller's contribution on "Cooperation: A Window of Opportunity for Entomological Systematics" hits this topic right on the head. Mechanisms for enhanced communication have been presented via ICN contributions and the establishment of ENT-LIST by Mark O'Brien (see ICN-4).

#### PROBLEM 2: Efficient Use of "Standing Collections"

Given the incredible diversity of Insecta, it is highly unlikely that any one organization will ever have the human resources to cover all groups. The NMNH has established an Offsite Collection Enhancement Program to address this problem. This has been discussed above by David Wahl (see ICN-4 for further details).

#### PROBLEM 3: Specimen Processing Bottlenecks - Future Collections

David Wahl's contribution on "Cooperative Resource Utilization" presents an overview of our plans for specimen processing agreements. To expand on Wahl's contribution I present the details of the MOU under consideration.

#### MEMORANDUM OF UNDERSTANDING DRAFT, 11/15/90

#### NMNH-AEI Specimen Processing Agreement: Ichneumonidae

This agreement concerns the mounting and labeling of various lots of unmounted Ichneumonoidea (Insecta: Hymenoptera) that are the property of the National Museum of Natural History, Smithsonian Institution ("NMNH"), whose address is Washington, D.C. 20560, and the American Entomological Institute ("AEI"), whose address is 3005 SW 56th Ave., Gainesville, Florida 32608.

1. NMNH will send to AEI lists of specimen lots of unmounted ichneumonoids that are available with brief descriptions of their origins, quantities, and conditions. From such lists, AEI will select lots to be mounted and labeled.

2. From the lots sent for mounting and labeling, the AEI will select those specimens of *Ichneumonidae* for processing that appear to have research importance. The selected *Ichneumonidae* will be mounted, labeled, and sorted at AEI. From these specimens, half of each species series will be returned to the NMNH and half kept by AEI as its own property. Specimens not mounted and labeled at AEI will be returned to the NMNH unmounted.

3. Sorting will be to morpho-species. No effort will ordinarily be made to formally identify specimens to species, i.e., provide species names. For certain poorly known groups, genus will not be specified. Identification will be on the order of "Mesoleiini sp. 1," Mesoleiini sp. 2," etc.

4. Where there is an odd number of specimens of a species or a single specimen, the odd or single specimens will be returned to the NMNH. In the case of single specimens that are of special interest to AEI, these can be retained on loan by separate agreement.

5. Primary types from NMNH material shall remain the property of the NMNH. AEI and NMNH will attempt to reunite split specimen series by communicating the terms of this agreement directly to potential borrowers and through notices in appropriate publications, such as *IchNews* (international newsletter for ichneumonid research), and *Insect Collection News* (ICN, newsletter for entomology collections).

6. Costs of shipping from NMNH to AEI will be borne by the NMNH. Costs of shipping from AEI to NMNH will be borne by the AEI; this may be modified if the NMNH ichneumonid collection is sent to AEI on long-term loan. Pins will be provided by AEI. Labels will ordinarily be provided by NMNH, except when AEI desires specimen lots that the NMNH is not immediately planning to process; in this case, AEI will provide labels.

7. AEI agrees to attach NMNH "restriction labels" to individual specimens; separate colored labels that reference discrete numbers associated with specific agreements will facilitate the return of primary type material, reunification of split series, and help insure that various agreements/convenios between the NMNH and other countries will be upheld. Restriction labels will be provided by the NMNH.

8. A period of two years is agreed upon as the period between shipment to AEI and the return of mounted and unmounted specimens to the NMNH (subject to renewal by agreement of both parties). These transactions will be processed as formal loan agreements, similar to the loan of mounted specimens.

9. AEI, in association with its own annual report procedure, will provide the NMNH with a yearly status

report concerning specimen lots associated with the terms of this agreement. A brief report will be forwarded to the NMNH chairman each January.

10. Either party may terminate this Agreement upon giving thirty days written notice. However, specimens already mounted and labeled at AEI shall come under the original or standing agreement.

11. The terms of this Agreement may not be modified except by written agreement signed by both parties.

ACCEPTED AND AGREED:

For the American Entomological Institute

\_\_\_\_\_ Date \_\_\_\_\_

Virendra K. Gupta,  
President/Director

For the National Museum of Natural History

\_\_\_\_\_ Date \_\_\_\_\_

Frank H. Talbot,  
Director

REFERENCE

Kosztarab, M. and C.W. Schaefer, 1990. Conclusions from the Symposium. In *Systematics of the North American Insects and Arachnids: Status and Needs*. Virginia Polytechnic Institute and State University, Virginia Agricultural Experiment Station Information Series 90-1, Kosztarab, M. and C.W. Schaefer, eds.



**The Significant Role of Small Systematic Institutions**

**Role of Small Systematic Collections**

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This position statement is oriented primarily towards small collections at publicly supported institutions, and is based on experience with collection development at a Land Grant University. The primary goals of a small institutional collection should be those of the systematics collections community (Irwin et al., 1973): 1) management of specimens and associated data, and 2) addition of new specimens and data. Small collections should follow ASC guidelines for acquisition and management of biological specimens and meet the criteria for suitable repositories (Lee et al., 1982).

1. Data Management

All small state collections should have a database for holdings to include minimal data fields of a) name (or acronym) of collection, b) family, c) genus, d) species, e) country and state where collected. Other data fields, including label data, number of specimens, and stage preserved, should be entered for taxa exchanged with other institutions and retained by researchers from loans.

2. Growth

Acquisition policies should support institutional, state, and national goals, and should be oriented primarily towards habitats rather than taxa (it is recognized that strengths in holdings may reflect specialized interests of past and present systematists associated with the collection). The first priority for collecting localities should be unique or threatened habitats in the home state. The collection should work with the Natural Heritage Program or Wildlife and Conservation Department of their respective state,

and with botanists and ecologists to identify unique and threatened habitats in which to conduct surveys. Acquisitions should originate from a balanced combination of state surveys, research, and donations. Lack of space for additional growth should be compensated by transferring portions of identified series to other collections that meet ASC guidelines as a suitable repository. All material transferred to another collection should have the minimal data fields entered on a database in the state collection.

Any factor that causes lack of growth, which precedes collection neglect and loss of material, should be considered a hazard to the collection. Personalities, politics, lack of public relations, and competition within a department and institution and between institutions should be recognized as factors that can cause lack of growth.

3. Service

In addition to the role the state collection has in supporting research and education, the collection should provide taxonomic services to the resident department and institution, the various state agencies, and citizens of the state. Such cooperation should increase in state awareness of the value of systematic resources and can provide indirect monetary dividends. Some recipients of these services should be potential donors of literature and other collection materials. Deposition of voucher specimens should be a requirement for all researchers working in the state, and maintenance of these voucher specimens should be a service provided by each state collection.

4. Administrative Support

Moral support and commitments of responsibility from institutional administrators is essential for funding. Individuals and groups who have benefited from service activities can influence college/university administrators. The department and administration must be forced to make a decision as to whether a collection is desired. The administrative desire to maintain a collection should be validated by a minimal level of funding. In addition, the ad-

ministration must provide guidelines for rewarding the curator for collection management at the expense of research productivity. In the absence of moral and financial support, the curator's top priority should be the transfer of the collection to another institution that is a suitable repository. Any collection maintained by a curator without institutional support should be a personal collection of the curator's specialty and should not include acquisitions from donors, researchers, and previous curators or museum staff.

#### 5. Alternative Funding

Fees should be charged for identifications and other services requested from researchers outside the home state, if that research is supported with public or grant funds. Administrators who review research proposal budgets should be made aware of the costs for providing taxonomic services and maintenance of voucher specimens. Researchers who require taxonomic services should include appropriate costs for these services in their proposal budgets.

Curators should work with administrators to establish endowments with institutional Development Foundations. Separate endowments should be created to fund collecting trips, publications, equipment/drawers, curatorial support, or other long term need, rather than creating one fund for general support of the collection. Such endowments can provide additional security to the collection if the endowment policy states criteria for suitable repositories, Institutional responsibilities for meeting these criteria, and plan of action to be taken if the institution does not maintain responsibilities. Endowments can be developed with donations, fees for consulting and taxonomic services, and the return of a portion of the annual earned income.

#### 6. Programs

Each state collection, singly or in cooperation with other collections in the same state, should establish a state arthropod survey, data management program, research/collection associates program, and

information (public relations) program, to include a newsletter or some form of collection sponsored publication. Administrators should be kept well informed of collection activities, especially donations. A Research Associate program, such as that developed by Howard Weems in Florida, will facilitate state surveys and collection developments.

#### 7. Experiment Station Projects

For collections associated with Land Grant Universities and Experiment Stations, a USDA-CSRS (Experiment Station) project should be established for state arthropod survey and data management. The separation of the collection (state survey) project from the research project of the responsible systematist is especially important to maintain the collection's identity and importance.

#### 8. Donations

The responsibilities, liabilities, and evidence of negligence of the institution, department, and curator for donated material should be defined in a policy that is given to donors. Donated material should be evaluated for federal tax purposes. Donations of specimens also may be made as "Gifts-in-Kind" through the University Development Foundation (or alumni organization). If the institution accepts the donation and the donor includes the monetary evaluation as an itemized deduction for tax purposes, the institution and collection is responsible for maintaining specimens or records of specimen disposition during the future period of potential audits.

#### 9. Policies

Policies should be developed for voucher specimens, loans, donations, accessions, and deaccessions (conditions under which all or a part of the collection is transferred to another institution). Administrative approval should be obtained for policies regarding donations and deaccessions.

#### 10. Reorganization

The corporate practice of declaring bankruptcy and filing for reorganization should be applied to state collections. For inactive and

poorly funded collections, systematists should form a committee of individuals representing the home institution, state agencies, federal agencies in the state, agricultural groups, and other concerned individuals, especially any individual with a "high political profile," to reactivate the systematic resources program. This committee should establish a "new" museum with a new name, give it a "new" mission, and develop a long term budget with a commitment of support from more than one state agency.

#### 11. Cooperative Networks

Cooperative networks should be developed with other collections in the state and neighboring states; reorganization, as previously described, should facilitate this process. For states with two or more institutional collections, centralization of specimen data in one of these collections should be a top priority. The collection with centralized data should serve as a broker for other collections in the state, and possibly neighboring states. Brokerage collections should have the responsibility of supplying data and loaning specimens to systematic researchers elsewhere and should retain a portion of each identified series that originates from another collection in the network. Redundancy in holdings, data, collecting trips, etc. among two or more collections within a state should be reduced, while ensuring that systematic programs at each institution are benefited.

#### References

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