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PRESIDENTIAL ADDRESS, 1986: UNEXPLORED HORIZONS—THE ROLE OF THE AMATEUR LEPIDOPTERIST

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During the past few years, members have voiced various concerns about our Society, its meetings, and the nature of some papers published in our *Journal*. Comments include: 1, The Society is only for professionals these days. 2, The papers presented at meetings are too technical—where are the informal field trip–slide show presentations of old? 3, Only specialists can read the *Journal*. 4, How can an amateur hope to contribute or gain anything from membership in the Society?

Before I respond to these comments, let us look at who is an amateur and who is a professional. One definition is that a person who is paid for his efforts is a professional, and a person who does the same job without being paid is an amateur. An alternative definition might be that a person with formal training (meaning a college degree) in entomology or zoology is a professional (in the context of our Society), while a person who lacks such training is an amateur. Perhaps it would be better to use the term lay person rather than amateur. By either definition, I am a lay person, as are many other folks sitting in this room. I am a scientist by training, but not formally trained as an entomologist or lepidopterist, and with one exception in the past, not paid to work only with insects.

Among the people in this room are physicians, dentists, lawyers, engineers, professors and teachers, scientists from various disciplines, housewives, individuals who simply like butterflies and moths, young people, students, and yes—a few paid professional entomologists. Our Society is composed of a very broad spectrum of disciplines and interests, and the membership as a whole is not much different from the sample here today.

In his 1984 Presidential Address at the Alberta Meeting, Lee Miller singled out the myriad contributions made by amateurs to the study of Lepidoptera. Many of the past giants in our field were not professional entomologists. Skinner was a physician, Scudder a librarian, Henry Edwards an actor, Lord Rothschild a banker, William Henry Edwards a coal baron, Bates a naturalist and explorer, Bean an artist, and the list goes on. All of these individuals had one thing in common—they were interested in nature. The term used in those days was naturalist. Amateur or professional had no meaning. A naturalist was simply a person who was interested in and observed nature, and most naturalists were self-educated. They learned by reading, observing, and conversing or corresponding with other naturalists. It's a shame this term has nearly fallen from use, at least in North America.

We here are all naturalists with a common interest in Lepidoptera. So let us call ourselves naturalists whose major interest is lepidopterology. The only differences among us are the degrees to which we pursue our common interest. Some of us are field people who delight in collecting or photographing butterflies and moths. Some of us pursue rearing and life-history studies. Some of us work with nomenclature and classification, the field of taxonomy. Others of us look at details of behavior, genetics, and molecular biology as they relate to Lepidoptera. A few of us dabble in each of these areas.

Now let us look for a moment at how science and the ways of doing science have changed in recent years. Two major discoveries, one each in the physical and biological sciences, have altered our approach to all scientific disciplines. In 1947, the year in which our Society was founded, the transistor was invented, and it subsequently evolved into the microcircuit chip and microelectronics. Microelectronics has given us the tools and the ability to construct analytical instruments that measure physical and biological processes to a degree of accuracy and sophistication undreamed of by 19th and early 20th century naturalists. In 1953, Watson and Crick proposed the double-helix model for DNA (deoxyribonucleic acid), and molecular biology was firmly established. Knowledge of DNA structure coupled with electronic instruments designed to probe and elucidate this structure led to the deciphering of portions of the genetic code, and to the birth of genetic engineering and biotechnology. Discoveries being made in molecular biology are changing our ways of looking at biological phenomena, and are even changing our thinking about what constitutes a species and how we approach taxonomy and nomenclature. This should explain why some

Journal articles and meeting papers appear abstract—we are caught up in a bioscience revolution. Today biotechnology is the frontier of the biological sciences.

Biotechnology and related research require extensive laboratory facilities and sophisticated instrumentation. Such facilities are normally associated with large universities and research centers. Thus only a limited number of specialists are equipped to undertake studies of Lepidoptera at the molecular level.

Now, what about the rest of us? Do we have any open frontiers, and if so, where are they? The answer is yes, they are all around us! While molecular biology, with all its sophisticated methods to probe the very nature of life, is giving us information about similarities and dissimilarities among insects based upon laboratory analysis, it tells us nothing about how those same insects behave in their natural environments.

At one time, many specialists thought that species of Lepidoptera could be separated positively based upon such morphological differences as color, wing maculation, and genitalic structure. More and more, we are finding out that this is not so. In the genus *Colias,* for example, the male genitalia are essentially identical and wing paterns are similar; yet in the field these butterflies clearly segregate into recognizable groups that we call species. On the other hand, individual colonies of *Erebia callias* in North America and *Erebia tyndarus* in the Old World exhibit clearly defined polymorphism in male genitalia, although wing maculation remains constant.

In the western United States, there is the *Speyeria atlantis* complex which may represent a single species with multiple subspecies, or numerous closely related but separate species. To date, even the molecular biology approach has failed to decipher this complex. In the long run, probably careful field observations of mated pairs of these butterflies along with rearing adults from ova will resolve the species-subspecies question. The foregoing are just a few examples of problems that require further study. There are hundreds of unsolved problems in the moths, and in both tropical and arctic fauna.

Our frontier is the field and our mission is to study how Lepidoptera behave in their natural habitats. From field observations, we now know in *Speyeria mormonia* that the unsilvered "clio" form is really only a form. Mixed pairs are regularly observed *in copulo*. On the other hand, we have yet to resolve the relation of the dark-disc *Speyeria atlantis electa* to the pale unsilvered-disc *Speyeria atlantis hesperis*. In many areas these two butterflies are sympatric. They were described over 100 years ago, and we still don't know their true taxonomic status. Are they varietal forms, subspecies, or species? There are many such problems just with the species found within the forty-eight contiguous States and southern Canada. Collecting in the arctic and the tropics is uncovering many more unanswered questions.

For many of us, our laboratory is the out-of-doors wherever butterflies and moths occur. Our experimental work is to observe how these insects behave in the field and to rear them so that their life stages become known. We need to know flight patterns, courtship behavior, and life histories. Maybe then we can solve some of the many unanswered taxonomic questions. Frequently collectors simply collect insects and check the species off on a list. We need to pay more attention to how lepidopterans behave in their natural environments.

This is an area where nearly all of us can contribute. The only equipment required is a good pair of field boots or shoes, notebook, pen, binoculars, camera, and for some a butterfly net and other collecting paraphernalia. In many cases, the camera and binoculars can be omitted. The final ingredients are patience and perseverance. We need to know and record where lepidopterans fly, how they perch, their courtship patterns, how they oviposit and upon what, and their behavior in general. If we go into rearing, we need to record what the eggs look like, what the larvae look like in each instar, what they eat and what portions of the host are consumed, what the pupae look like and where they are placed. Do the larvae overwinter, or is hibernation as ova or pupae? These are simple and basic questions, yet they remain unanswered for some common and widespread species. Most lepidopteran rearing requires only simple equipment. Some sort of rearing cage is desirable, a container for the larval foodplant, soil for species that pupate on or in the ground, and twigs or other substrates for species that pupate above ground.

One of the most famous behavioral entomologists was J. H. Fabre who is known for his book *Social Life in the Insect World.* Fabre was an impecunious French naturalist who observed insect life about his garden; he was too poor to travel, yet his work is renowned the world over. Of equal stature to Fabre is Theodore D. A. Cockerell, who at age 20 traveled from his native England to the Rocky Mountains of Colorado in the hope that his tuberculosis would be arrested. His hope was realized and he died at the age of 82, renowned as a naturalist, scholar, and ultimately a professor at the University of Colorado—all without a university degree.

What are the benefits of the studies mentioned above? They provide useful and very necessary information. It is only through such field observations that we will utimately understand the complex relations among many lepidopterans. The side benefits are recreation and just being in the out-of-doors close to Nature and her wonders.

Now I would like to share with you some of the problem species that have intrigued me for the past several years. My major interests lie with the arctic and arctic-alpine fauna, and the examples which follow derive from these. First is the satyrid *Oeneis bore*. For many years, the taxa *bore* and *taygete* were considered to be separate species, and were so treated by dos Passos in his 1964 Synonymic List. About a decade later, a paper of his read at an annual meeting of our Society suggested that these two taxa are conspecific, and some subsequent lists have taken this approach. The basis used to separate *bore* and *taygete* related to whitish veining on the ventral hind wings, present in *taygete* while absent in *bore,* although male genitalia appear identical. As more arctic material became available for study, it was evident, based on the discovery of mixed populations, that the white veining was not a reliable character. The name *taygete* fell into synonymy under the older name *bore*. Based on my collecting in the Yukon and northern British Columbia in 1984 and 1985, it now appears that this situation is not so simply resolved. While it is true that the white-venation character is unreliable, there are clearly two phenotypes that fly together: one dusky and the other brightly colored. A casual observer, seeing only a few specimens, might simply write off these differences as normal variation within a geographic population. Series have been collected, however, at several locations in the Yukon and northern British Columbia. Flight patterns are different and no mixed-phenotype mated pairs have been observed. Opposite sexes of opposite phenotypes ignore one another. Preliminary examination of the male genitalia indicates no difference between the two color forms. In the field, the butterflies behave as two separate species; in the laboratory working with museum specimens, we would treat them as one species after applying the usual taxonomic methods.

Oeneis polixenes in the western arctic behaves in a similar manner. There is a dark phenotype and a pale one. I first collected two females of the dark form in a bog in eastern Alaska in 1971. At that time, I simply discounted these specimens as melanic aberrants. Several years ago, Jim Troubridge of Cayuga, Ontario, pointed out to me that this dark phenotype occurs only in odd-numbered years, while the paler typical *polixenes* is annual. His collecting led him to believe that the biennial dark form occurs at low elevations in forest bogs, while the normal form occurs in more open areas and on mountain tops. In some localities, both forms can be collected where there is a fairly abrupt transition from boggy forest to open grassy hillsides. In 1985, I found that the dark form is not restricted to low-elevation bogs when I collected a few examples on the summit of Pink Mountain in northern British Columbia. As is the case with *bore,* the flight patterns for the two forms are quite different and I have not yet seen mixed pairs *in copulo*. No differences in male genitalia have been detected. The dark *polixenes* is found in parts of Alaska, the Yukon Territory, and northern British Columbia.

It is not surprising that paradoxes are turning up in the western Arctic. Until recently, collecting in this region was limited, and one is frequently inhibited by weather. New roads into previously uncollected areas, and collectors fortunate enough to encounter hot dry weather at the right time of year have resulted in the discovery of some fascinating yet perplexing butterflies. On the other hand, new species and subspecies have turned up in heavily collected parts of America; witness *Clossiana acrocnema* in 1978 along a heavily traveled hiking trail in southern Colorado, and *C. improba harryi* in 1982 in central Wyoming, also along a well traveled trail. Many surprises are turning up in Idaho, largely through the efforts of Nelson S. Curtis of Moscow, Idaho. Again we see the situation of differing phenotypes and voltinism of a supposed single species, this time in the *Coenonympha tullia* complex. In one area of Idaho, there appears to be a univoltine population on the wing between flights of bivoltine population. Only careful field observations (like those by Curtis) can elucidate this sort of situation. From museum material, one would simply infer an extended flight period of a single species.

Elsewhere in Idaho, traditional species concepts appear to break down. This situation is most evident in Valley Co., where among others, apparent hybrids or intergrades between *Speyeria atlantis* and *S. hydaspe*, *Euphydryas anicia* and *E. chalcedona*, and *Colias interior* and *C. pelidne* have been collected. The *Colias* population is particularly interesting in that instability of phenotype is the rule. Both wing shape and maculation vary widely. This population was first discovered by Jon Shepard of Nelson, British Columbia, and its geographic range has since been studied by Curtis and Ferris. It is not yet clear why Valley Co. fosters so many unusual butterfly phenotypes. The moths collected there have produced nothing unusual.

As a final example, we return to the Arctic and the *Colias hecla* complex. Several years ago, I described *Colias hecla canadensis* from Alberta and British Columbia. A somewhat similar butterfly occurs in the northern Yukon and sporadically in Alaska. It is not clear if two species are involved, or simply temporal forms of *C. hecla*. In the Ogilvie and Richardson Mts. in the Yukon, *hecla* that appear early in the season have pale-colored males with narrow wing borders, and females that are on the wing at the same time are usually white or very pale yellow with perhaps an orange flush. As the season progresses, brightly marked typical *hecla* appear in which the females are bright orange-yellow and the males have broad dark wing borders. Are two species involved, or does climate play a role? Do the early-emerging adults represent perhaps last instars entering hibernal diapause while the later-emerging adults represent penultimate-instars at the time of hibernal diapause? Or does the early group of pale adults represent larvae that passed two winters, while the later-emerging bright specimens passed only one winter as larvae? Do climate and larval development at the time of diapause or pupation effect selective expression of adult color (leucopterin rather than xanthopterin in the females)? At this point, I cannot answer these questions. More fieldwork is needed and probably eventual rearing of adults from ova under controlled conditions.

Now we return to the questions posed at the beginning of this presentation. In short, how does the lay person fit into the Lepidopterists' Society today? I would suggest simply by being a naturalist. The frontier is still in the field as it was a century ago. We still have much to learn about familiar butterflies and moths, and even more to learn about species that occur in remote regions. Since the discovery of *Clossiana acrocnema* a few years ago, other new species described from North America only include *Oeneis excubitor, Erebia occulta* and *E. lafontanei,* and *Mitoura thornei.* There are undoubtedly other unknown species. There is also the enigma of *Erebia inuitica,* known from a single specimen. No amount of sophisticated laboratory work is going to uncover uncollected new species. Only a lot of leg work in the field will accomplish this. Laboratory instruments will not help us determine the geographic distributions of the many little-known butterflies and moths that occur in North America and elsewhere. In some tropical regions, species may become extinct without our knowing that they ever existed, owing to extensive destruction of virgin jungle and lack of collecting.

I have described a few unsolved problems that are of interest to me. In some cases, analytical methods derived from molecular biology *might* answer questions, but where they have been tried (in *Colias* and *Speyeria*) results so far are disappointing.

What we do need is more field naturalists studying behavior, life history, and producing distribution maps. Simply accumulating data but not sharing information is not enough. The contribution that a member of our Society can make to the group as a whole is by sharing discoveries. What the member then gains is the satisfaction of making a scientific contribution and extending our knowledge of the natural world.

Some members may suggest that they are too old or have physical disabilities and thus cannot conduct field studies. Yet I know of some

Society members who are in their eighties and still actively collecting in the field. Many years ago, I exchanged specimens with a collector in England, who sent me fine examples of British butterflies and moths. One day I received a letter from his mother informing me that my correspondent had died. He was in his early twenties and had been an invalid confined to a wheelchair, but undaunted by his physical condition he reared butterflies and moths from live material supplied by friends. So nearly anyone can contribute to lepidopterology.

In closing, I give you this challenge: the natural laboratory is waiting for you, whether it be your garden, the mountains, the prairie, the desert, the arctic or the tropics. The butterflies and moths are there. Go find out where they live and how they live, and then share your findings with the rest of us. You will have the satisfaction of knowing that you have made a contribution to your colleagues and that you have extended our knowledge of Lepidoptera. I wish you Godspeed.