how does plant chemistry affect interactions between phytophagous insects and their enemies and symbionts?

Taken together, the chapters develop four general points. Point one: It is not only phytophagous insects, but also their predators and parasitoids, that use plant compounds to find their hosts. After illustrating how particular parasitoids use the compounds as cues, several authors argue that manipulating concentrations of plant compounds through breeding or genetic engineering could be useful as a means of attracting predators or parasitoids. But the effects of changing concentrations will not always be predictable. Different species will respond to changing concentrations in different ways. Increasing concentrations of particular compounds could increase attraction of particular parasitoids, but it could also increase attraction of host-specific herbivores. Achieving the concentration that minimizes damage to crop plants will not be easy.

Point two: Even in the absence of predators or parasitoids, interactions between insects and plants are seldom the pairwise relationships they are depicted as being. Most of these interactions are mediated by microorganisms that are either antagonistic to or mutualistic with these species. Insects often have endosymbionts that detoxify plant compounds, or, in some species such as wood-boring beetles, ectosymbionts that they release mechanically onto their host plants. Consequently, in some cases the evolutionary trajectory of insect-plant interactions may be determined as much by changes in the symbionts as by changes in the plants or insects.

Point three: Plant compounds affect not only the development of herbivores but also that of their parasitoids. Barbosa shows how different parasitoids respond quite differently to increasing concentrations of compounds such as nicotine. And a wholly different pattern of response occurs if the compound tested on the same group of parasitoids is rutine rather than nicotine. Moreover, host-specific and less host-specific species have very different responses to increasing concentrations of these compounds. There are few other studies with which to compare these results. So the emergence of any general patterns in how parasitoids respond to plant compounds (for example, differences between ectoparasitoids and endoparasitoids or between parasitoids of larvae and those of pupae) will have to wait.

Point four: Herbivores can sequester or transform plant compounds and use them as defenses against their enemies. Here variation in levels of compounds within plant populations can have important evolutionary effects. As Bowers notes, herbivores feeding on plants with different concentrations of a compound will themselves sequester different concentrations. Consequently, mimicry complexes based upon the sequestering of plant compounds may vary between Batesian (unpalatable model, palatable mimic) and Müllerian (all species unpalatable) mimicry over space and time. Variation in concentrations and mixes of compounds must surely be a common occurence within plant populations. How this variation affects the evolution of interactions among plants, herbivores, and higher trophic levels has only begun to be explored. Getting the answers will require a population approach and a focus on the variance rather than the mean outcome in these interactions.

Overall, these chapters highlight the diversity of ways in which the effects of plant compounds can ripple through herbivores to other species in a community. But the chapters also tell another story. The interactions that have been studied in detail are few and far between. Moreover, no study has shown how all four general points developed in these chapters mold a particular interaction between a plant population and its herbivores, enemies, and symbionts. But then these would not be called "novel aspects" if such studies were easy to find in the literature.

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Mutation

Eukaryotic Transposable Elements as Mutagenic Agents. MICHAEL E. LAMBERT, JOHN F. MCDONALD, and I. BERNARD WEINSTEIN, Eds. Cold Spring Harbor Laboratory, Cold Spring Harbor, NY, 1988. xvi, 345 pp., illus. $77. Banbury Report 30. From a conference, Cold Spring Harbor, NY, April 1987.

Back in 1923 Hermann J. Muller complained that studies of mutation were like a dingy basement beneath the imposing edifice of genetics. Fifty years later mutation was still considered one of the dullest subjects in genetics except among a few stalwarts. The dim view arose in part because there was little immediate prospect of analysis at the molecular level, in part because tautomerization of the bases was widely accepted as the principal mechanism of nucleotide substitution, and in part because a sort of mutational fatalism was assumed in which genes that got zapped stayed zapped.

Around 1970 there came some glimmers of light into the dingy basement. It was discovered that certain kinds of genetic damage could be repaired. A host of unorthodox chemistries were identified as more important than tautomeric shifts. And transposable elements were recognized as a significant cause of spontaneous mutation. Granted that Barbara McClintock had discovered transposable elements many years earlier and understood pretty thoroughly what they were, their existence had a broad impact on the field only after they were discovered in the right organism (*Escherichia coli*) and at the right time for molecular analysis.

This provides the background of the 30th in a series of Banbury Reports of conferences focusing on areas of molecular biology related to risk assessment in mutagenesis and cancer biology. The book includes 29 papers of which ten deal mainly with mammals, nine with *Drosophila*, five with yeast, two with maize, and three with bacteria. These papers are divided into five sections dealing with prokaryotic transposable elements, mutational effects of transposable element insertions, host effects in induction and regulation, genomic stress and environmental effects, and factors influencing retroviral expression. The list of participants reads like a Who's Who of transposable element researchers, and the papers are of uniformly high quality. They are, however, all quite short and therefore synoptic. They are also unequal in level. Some are rather general minireviews, whereas others resemble research reports in emphasizing experimental detail.

Melvin Green contributes a paper of each kind. His overview of mobile DNA elements and spontaneous gene mutation in *Drosophila* is one of the best papers in the book. His other contribution, with collaborators Pamela Geyer and Victor Corces, deals with the molecular analysis of insertion mutations and revertants of the yellow gene. I single out Green's contributions because a number of mutations he discovered in the dingy-basement era have proven critical in making the molecular analysis possible. (Some basement.)

I must also single out a paper by Nickolai Tchurikov *et al.* describing bursts of transposition of unrelated elements in *Drosophila* and claiming that deletions in the white-eye gene can revert to wild type. These observations are potentially of fundamental importance and may provide a way to study the murky issue of "genomic stress." I personally remain skeptical until alternative explanations can be eliminated.

There is also a discussion of radiation risks in which Krishnaswamy Sankaranarayanan argues that the occurrence of insertion mutations in humans would invalidate the doubling dose method for evaluating genetic risks of radiation. This is a serious allegation because the method is the cornerstone of radiation risk assessment. I think the argument is incorrect. The doubling dose is defined as the dose required to give a rate of mutation equal to twice the spontaneous rate, irrespective of the molecular basis of the mutations. However, the issue is moot since Sankaranarayanan concludes that the doubling dose method should not be abandoned anyway.

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Ceramics and Territory

Stylistic Boundaries among Mobile Hunter-Foragers. C. GARTH SAMPSON. Smithsonian Institution Press, Washington, DC, 1988. 186 pp., illus. $31.50. Smithsonian Series in Archaeological Inquiry.

A decade ago C. Garth Sampson and his research team undertook an archeological survey of some 5000 square miles in the South African central plateau, where they located 16,000 archeological sites and observed a "staggering amount" of surface archeological material, primarily lithics and ceramics. This amazing yield led Sampson to undertake a systematic survey of the upper valley only—a mere 2000 square miles, which is ambitious by any archeological standards—with the goal of collecting the ceramics, which came from 987 localities. This monograph is the analysis of *some* of those ceramics: about 7043 decorated sherds deriving from a minimum of 2815 bowls. Its explicit aim is to elucidate the territorial (that is, sociopolitical) boundaries of the Stone Age peoples who occupied the Upper Seacow Valley.

The people who are believed to have left the remains are termed Bushmen or "parahistoric" hunter-foragers (not gatherers or collectors, although the data to support the label forager are admittedly not yet available). The name Bushmen is intended to distinguish them from the living Kalahari San, whose precise genealogical and cultural relationship to them is not discussed or considered necessarily relevant, and the analogies that are drawn (and drawn often!) from the Kalahari San are said not to be direct historic analogies.

The archeological remains of the Bushmen hunter-foragers are usually referred to as the Smithfield industry and can be traced back to the 14th or even the 8th century A.D. in various locales in southern Africa. Since excavations in two stratified rockshelters in the Upper Seacow valley yielded some European materials in the uppermost centimeters of deep (38-centimeter) accumulations of Smithfield materials, it may be that Bushmen occupied the area into the late 18th and early 19th century, but we are given no "earliest" dates for their presence or any sense of how much time is represented by the surface collections analyzed here. This lack of chronological context is a significant problem that is not adequately addressed.

Moving easily from ethnoarcheological and ethnographic observations of the Kalahari San to the Upper Seacow River archeological context, Sampson envisions that the Upper Seacow Bushmen were highly mobile and undertook periodic (band?) movements between waterholes and shorter-term family or individual movements in and out of camp. Chapter 1 generates the model of a band territory that predicts the distribution of "emblemic style," in the terminology of Wiessner, as drawn from and then mapped back onto the core-area, annual-range, lifetime-range mobility patterns known from ethnographic observations of several families of the Dobe !Kung.

More than 70% of the book is given over to the ceramic analysis, which involves a suite of methodological operations and mappings to infer the "spatial organization of style" and refers back to the "predictive model" set out in the first chapter. One can only marvel at the combination of assumptions, techniques, and interpretative musings that yield a variety of patterns in the spatial distributions of various decorative motifs and techniques. Since the unquestioned "bedrock assumption" (p. 171) is that there *are* stylistic boundaries that are, in turn, "signaled" by ceramic motifs, Sampson pursues various methods in order to figure out "how boundaries are likely to reveal themselves" (p. 171).

For the student of spatial analysis in archeological research, there is a gold mine here: isopleth maps, isometric distribution maps, analyses and mapping of accumulative percentage differences, for example, that are considered in light of such factors as topographic variables (such as presence of river channels or mountain ranges) and problems of sample size. A critical reading of how the maps may create as much as "reveal" boundaries could be a valuable exercise for a graduate seminar. There must be at least 150 maps and figures in just 170 pages, not including the dozens of close-up photos of the various rocker stamp and non-rocker (small spatulate and double-tip stylus, for example) motifs on ceramic sherds.

Overall, the book is written in an eloquent style that, however, often begs the most interesting issues. Despite the impressive archeological fieldwork and ingenious and meticulous analysis, Sampson never really engages the difficult conceptual framework of "style" or the question why these Bushmen would have "sent" stylistic messages about "group" in ceramic motifs. There is not (yet?) any archeological support for the problematic notion that pottery decoration as group signaling would first appear under conditions of stress induced by scarce resources or population crowding. Despite the fact that a rich, diverse, and contested literature on style exists, there is no real questioning of Wiessner's types of style ("emblemic" and "assertive"), and the most interesting interpretative issues are taken up only in a 5-page final chapter. In the end, we are left with rather unsatisfying observations about the archeological study of style: since we have yet to be able to use lithics to make inferences about style, and since this hunter-forager context offers thousands of ceramics that appear more amenable to such decoding, there is adequate justification for a stylistic analysis. But the really interesting contextual question that this work implies is avoided: why, in this particular social and historical context, would ceramic motifs have been sociopolitically meaningful to and symbolically deployed by the Bushmen hunter-foragers?

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Books Received

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