nomic and phylogenetic usefulness of secondary metabolites in proper perspective by including cautions about the limitations of micromolecules at higher taxonomic levels, given our relative ignorance of the genetics and enzymology of their biosynthesis.

Chapter 9, on how environmental and genetic factors affect chemical variation, is important because plant taxonomists want to employ only variation having a genetic basis. The authors discuss a number of important studies, including McClure and Alston's work on flavonoids in duckweeds and Adams's extensive investigations of terpenoids in junipers. I think they should have discussed van Brederode et al.'s extensive research on the genetic basis of flavonoid variation in the Caryophyllaceae because few other labs are carrying out coordinated studies of genetics and enzymology. Langenheim's long-term research on environmental and genetic components of terpenoid variation in Satureja likewise would have fit well in this chapter.

The extensive chapter on chemical documentation of hybridization covers in great detail the classic studies (e.g., Baptisia, Juniperus) as well as more recent investigations. The authors offer a balanced discussion of how chemistry combined with morphological data can provide refined insights into hybridization dynamics. The section on the effect of polyploidy on chemical constituents should have included Levy's work with *Phlox* flavonoids because his research involved actually synthesizing polyploids and subsequently comparing flavonoids expressed in the progenitor diploids and their tetraploid derivatives. An important implication of this research is that investigators must be cautious when using flavonoids for inferring the origin of polyploids.

The chapter on proteins covers electrophoresis (both storage proteins and enzymes), fraction I protein analysis, serology, and includes a comprehensive discussion of amino acid sequences and their contributions to studies of flowering plant phylogeny. The authors place in perspective both the strengths and limitations of this approach. They also recapture the original excitement sparked by the awesome potential of macromolecules for inferring angiosperm phylogeny. This, I suspect, is in no small measure because Turner was one of the few plant systematists who initially distinguished between the phylogenetic information contained in proteins (despite attendant problems) and the information furnished by morphology and secondary metabolites. My only concern about their discussion of protein sequences is that it does not indicate the rapid rate at which nucleic acids are replacing proteins as the objects of sequencing or why this is occurring.

The short section on isozymes overviews methods and taxonomic applications of isozyme analysis. This section is a bit skimpy and would have benefited from more in-depth discussions of the basic rationale for using isozymes and the kinds of systematic and phylogenetic questions that the method can and cannot address. Discussing the taxonomic value of allelic frequencies versus isozyme number would have been useful. A helpful table on page 437 indicates the primary systematic application of various types of protein studies, i.e., serology, sequencing, etc.

In a chapter on nucleic acids, the authors cite and discuss relevant literature and provide an accurate sense of the potential of molecules for examining plant phylogeny. Certainly they appreciate how much information is locked in these molecules and convey this well. I think they devote too much space to topics such as base ratios and DNA-DNA hybridizations and too little to more active areas such as DNA restriction analyses and sequencing.

The book's strengths are its modern, enthusiastic tone, generally comprehensive survey of the field, and excellent writing by both authors (readers familiar with the authors' publications will have little trouble telling who wrote what). I found less satisfactory the lack of discussion about some of the more recent literature and how the results relate to prior studies. Also, the authors could have considered macromolecular data more thoroughly, particularly by detailing specific studies.

Overall, this modern synthesis of plant chemosystematics should be on the shelf of every serious student of plant systematics and would benefit even those with only a passing interest in the field. Readers will come to appreciate how this hybrid discipline developed during the past three decades. The authors retain the youthful enthusiasm for research and discovery that has sustained their productive and distinguished careers. All chemosystematists have benefited tremendously from their efforts; this book adds to their long list of contributions.

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**GENETICS IN CHINESE HAMSTER CELLS**


This is a gigantic book packed with information, mostly about Chinese hamster cells, which the title should indicate but does not. Anybody who works seriously with Chinese hamster cells should no doubt invest in the book.

Among 29 chapters and two appendices are many fine reviews. The editor mentions in the preface that he
expects the book will be used as a classroom text. A main drawback to this, however, is considerable repetition among some chapters, for example, between I. Abraham’s and Howard and McCormick’s chapters. This redundancy could have been avoided since these authors are with the same institution. It is also absurd for the same graph to appear twice (pages 84 and 168).

The opening chapter by G. Yerganian contains some amusing history, except I was not amused to learn that Brookhaven National Laboratory did not keep its first set of hamsters. The diabetic varieties, useful for medical research, apparently resulted from in-breeding, and the genetics is very complicated. Neoplasms abound in inbred females. Yerganian draws the conclusion that to avoid transformed cells, embryonic cell cultures should come from a single embryo, since there is a relatively high incidence of transformation from some embryos, particularly females.

T. T. Puck describes many details of the Chinese hamster ovary (CHO) cell lines developed in his laboratory from one of Yerganian’s animals and their use in mapping human chromosomes in CHO-human hybrids. R. Sager’s chapter on Chinese hamster embryo fibroblast (CHEF) cells tells about the assay for tumorigenicity in hairless mice with these immortal diploid cells containing a stable chromosome complement. She points out that her laboratory has a CHEF cell variety that transfects well.

Many chapters contain practical details important to researchers working with CHO and other types of cultured Chinese hamster cells. For example, Gottesman tells us that serum that does not allow unclumped growth in suspension becomes usable when mixed with serum that does. He also mentions that if your freezer breaks down in the night, the cells survive much better in glycerol than DMSO.

In a chapter on cell fusion, J. W. Shay and L. S. Cram point out that karyoplasts, containing only a little cytoplasmid and all the nucleus, cannot become cells, showing that some aspect of the cytoplasm missing in the karyoplasts must be essential for viability. The Abraham and the Howard and McCormick chapters seem to tell everything about gene transfer in Chinese hamster cells as well as in other mammalian cells. Abraham makes the interesting point that frequencies of gene transfer differ very little from one gene type to another when DNA is injected into the nucleus, but there are large differences when the cytoplasm is entered first. Different DNA molecules entering the nucleus are ligated there. Insertions occur at different places on the host chromosome in different transformants and they are amplified to various extents, depending on location.

P. J. Doherty describes well the hazards of cDNA synthesis and expression of these DNAs. D. Patterson, in a chapter on purine and pyrimidine biosynthesis, mentions all types of biological systems and explains why CHO cells are particularly good for investigating the regulation of this biosynthesis. R. G. Fenwick thoroughly reviews HGPRT (hypoxanthine-guanine phosphoribosyl-transferase). He warns that HAT medium is sometimes toxic because of contaminating mycoplasma, which produces thymine from thymidine, and the aminopterin in HAT medium prevents formation of TMP. J. J. Wasmuth’s chapter includes ingenious methods of selecting and characterizing temperature-sensitive (ts) protein synthesis mutants. Because these are frequently recessive, the complementation tests to define the mutation become highly complicated. Fortunately, the invariably recessive amino acid tRNA-synthetase mutant frequently shows temperature-sensitive synthetase activity. These synthetase genes in Chinese hamster cells have made it possible to map corresponding human genes. Wasmuth also points out that ribosomal proteins from human cells can function in CHO ribosomes, aiding in mapping genes for human proteins. C. J. Ingles, writing on ts RNA polymerase mutants of CHO cells, shows how well conserved genes for this enzyme are, since one subunit is apparently antigenically related to the comparable subunit in Drosophila.

Reviews on dihydrofolate reductase by L. Chasin, asparagine synthetase by I. L. Andrulis, ornithine carboxylase by C. Steglich et al., and cAMP-dependent protein kinases by Gottesman all emphasize the importance of mutants in these activities, making it possible in some cases to isolate the relevant genes. Mutants were isolated by techniques varying from treatment with chemical mutagens, selection for drug resistance (such as that of ricin for glycosylation mutants), to agents such as tritiated uridine or tritiated ornithine. The point of most of these studies is to understand the regulation of these enzymes, an understanding aided by amplified transformant clones. In many cases regulation is extraordinarily complex and not yet well understood.

C. D. Whitfield reviews mitochondrial mutants that affect the respiratory chain. Mutants have been isolated by finding clones resistant to inhibitors of protein synthesis in mitochondria and oxidative phosphorylation. Whitfield makes clear that cytoplasmic inheritance takes place in Chinese hamster cells. M. Marcus thoroughly covers cell cycles and mutants. He emphasizes the necessity of finding ts mutants that are deficient in a particular part of the cell cycle and thus arrested in a particular growth phase. Analysis of Chinese hamster cell mutants lays far behind that of yeast, although Marcus shows that microinjected mRNA from wild-type Chinese hamster cells overcomes the block in S phase in one mutant. Fractionation of this mRNA then gives the size of the protein required for this part of the cell cycle.

In a chapter on DNA repair mutants, L. H. Thompson explains that CHO cells can do what we already know a great deal about in prokaryotes—excision of pyrimidine dimers induced by ultraviolet radiation (with incision the first step) and postreplication repair following damage from a variety of chemicals or from radiation. There are also mutants defective in rejoining DNA strand breaks. One of these also has very high sister chromatid exchange (SCE) without any treatment. The author does not discuss whether this strain could have two mutations and thus does not eliminate the possibility that the lack of strand-break repair may not be related to SCE frequency. Human DNA has been shown to complement some of the CHO repair mutants. It thus becomes possible to clone the human genes and (also not mentioned
by the author) to make mutations in human genes by in vitro mutagenesis.

M. J. Schibler and F. Cabral discuss microtubule mutations at length. Curiously, all the mutants already isolated have a drastic effect only on mitochondria. The authors conclude that microtubules may be essential only for that process. They emphasize, as does Gottesman on cAMP-dependent protein kinase, the importance of revertants, both to show correlation of biochemical changes and mutant phenotype and to introduce new types of mutations.

R. G. Worton and S. C. Grant's chapter concerns the problem of converting a cell containing a recessive marker to a cell expressing that marker. They discuss many possible mechanisms, such as gene inactivation, deletion, and chromosome loss, but in most cases, present little hard evidence for the mechanism. L. Siminovitch's chapter covers similar material more briefly.

The section presumably of most general interest concerns using Chinese hamster cells to study cancer. CHO cells are particularly useful for carrying oncogenes from human, mouse, or avian cells, as C. W. Roth explains, because of the CHO karyotype's stability. Using the src gene from Rous sarcoma virus in CHO cells is developing into an excellent way to investigate how tumorigenesis works. First, the src gene is used to obtain a transformed population; next, revertants are selected. Most of these are viral, but some are host alterations. The src gene can also be put into CHO cells following site-directed mutagenesis.

R. Sager contributes one of the best chapters, illuminating transformation of CHEF cells. She clearly explains why no cellular assays of tumorigenicity are totally reliable; she therefore used hairless mice. She cites experiments suggesting that mitochondria could be involved in the genetics of tumorigenicity and presents convincing data showing that multistep alterations are required for tumorigenicity in nontumorigenic CHEF cells, except perhaps where human oncogenes are involved.

The two appendices by Gottesman should greatly help those working with Chinese hamster cells. One shows lineage of various cell lines, and the other lists mutants in these lines. The index seems quite thorough; at least I, a relatively ignorant reader, was able to discover what EGF is.

Finally, some small but irritating details: On page 797 it is obvious that the author was not aware that molecular weight has no units; presumably, the editor did not know this either or did not catch the slip. The late Ross Granville Harrison of Yale University, formerly editor of a well-known journal, automatically rejected articles that said an animal was “sacrificed"; I share his annoyance with this antediluvian phrase, used several times in this book. After years of abuse, the phrase powerful tool should be relegated to the ashheap. Style is frequently inconsistent, particularly the names of restriction enzymes, which often differ within a single article (e.g., on page 200 HindIII, the correct form, appears on the same line as Hind III and HindIII, neither of which is correct). Perhaps these and other careless errors resulted from haste encouraged by what two authors describe as the editor's “well-timed threats.”

Despite these trivial faults, this is a valuable book, which has convinced me that Brookhaven National Laboratory made a mistake earlier in not exploiting the virtues of the Chinese hamster.

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ANIMAL POPULATION BIOLOGY


In their summary remarks, the editors specify the three strands of animal population biology as evolutionary genetics, population dynamics, and behavioral ecology; exploring the relations of the latter two strands is their objective.

The 34 chapters of this volume are collected into five sections. The first section provides selective reviews on such topics as evolutionarily stable strategies, sex ratios, r and K selection, demography, and then, oddly, the first of many ornithological chapters. Parker contrasts frequency dependence important in evolutionary adaptation and density dependence that influences population dynamics. Two of the chapters generalize in an interesting way the r/K spectrum. In one of these, Sibly and Calow suggest replacing this one-dimensional continuum with a two-dimensional one. One dimension reflects age-specific survival and the second, the growth rate of offspring. Each of the remaining four sections deals with population dynamics as related to feeding, spacing, breeding, and social behavior.

Next, among the chapters on feeding, Kacelnik and J. R. Krebs compare the abilities of different suggested mechanisms of learning to predict behavior under changing environmental conditions. Such comparisons are increasingly needed as the literature blossoms. Partridge and Green provide a broad and stimulating discussion of the manner by which intraspecific feeding specializations can arise due to variable food supplies, phenotypic differences, and frequency-dependent payoffs. Mann gives a good presentation of how sea urchin feeding modes shape marine benthic communities. Hanski makes good use of a Markov model in an examination of shrew energetics. Spacing behavior has multifarious effects in population dynamics, and the chapter by Sutherland and Parker includes theory for the distribution of unequal competitors. C. J. Krebs and Taitt's research...