KING, R. C., AND W. D. STANSFIELD. 1997. A Dictionary of Genetics. Oxford University Press, New York. vii + 439 p. ISBN 0-19-509441-7. Paperback. $24.95.

Here is a great book bargain! If you want to know what terms such as 'gene targeting', 'horizontal transmission', 'pseudogene', 'punctuated equilibrium', or 'telomerase' mean, this is the book for you. There are 6,600 definitions of genetic, evolutionary, and molecular biology terms, with 250 of them illustrated by drawings or tables. You get more than a dictionary in this volume, because it includes a series of appendices with an abundance of useful information, including a classification of organisms. You will be able to completely identify particular species referred to in the dictionary using this classification. A second appendix includes the common and scientific names of various domesticated species of plants and animals. The third appendix includes a chronology of important events in the history of genetics, cytology, and evolutionary biology from 1590 to 1996. There is an index to the scientists mentioned in the chronology, a bibliography containing approximately 100 important books on genetics and evolution, and a list of about 500 periodicals cited in the genetics, cytology, and molecular biology literature. Foreign words commonly found in scientific journal titles are translated into English. A list of genetic databases is included where you can locate data on specific genes, their products, and details on the genetics of species that are studied as genetic models, including humans, the mouse *Mus musculu*s, the nematode *Caenorhabditis elegans*, the bacterium *Escherichia coli*, and the fruitfly *Drosophila melanogaster*.

You will discover that insects have played a very important role in the history of genetics, evolution, and molecular genetics. Many of the milestones listed by King and Stansfield are based on studies conducted with insects, and especially the fruitfly *Drosophila melanogaster*. The following examples illustrate the role insects have played in advancing our understanding of genetics and evolution.

The theory of spontaneous generation was disproved in 1669 by Redi using fly maggots. Dzierzon initiated studies on sex determination in 1845 when he reported that drone bees hatch from unfertilized eggs while worker and queen bees hatch from fertilized eggs. Montgomery (1901) studied spermatogenesis in hemipteran species and concluded that maternal chromosomes only pair with paternal chromosomes during meiosis. In 1902, McClung found that equal numbers of two types of spermatozoa were produced in many insect species; one type had an "accessory chromosome" and the other did not. He suggested that the extra chromosome was a sex determinant and argued that sex was determined at the time of fertilization in both insects and humans.

Insects became a particularly valuable tool in studying evolution and genetics during the 1930s. Hashimoto (1933) described the chromosomal control of sex determination in *Bombyx mori*. L'Heritier and Teissier (1934) demonstrated that a deleterious gene disappeared from populations of *D. melanogaster* maintained in population cages for many generations, providing an example of natural selection in a laboratory setting. In the same year Bauer discovered that the giant chromosomes of the salivary gland cells of fly larvae are polytene, which allowed the banding patterns to be mapped. In 1935, Beadle, Ephrussi, Kuhn and Butenandt worked out the biochemical genetics of eye color synthesis in *Drosophila* and the flour moth *Ephestia*, and illustrated that series of genes were required to synthesize the final product. Also in 1935, Bridges published detailed maps for *D. melanogaster* salivary gland chromosomes that have been used to this day to locate specific gene locations. In 1936, Stern discovered somatic crossing over in *Drosophila* and Schultz noted that gene expression in *Drosophila* was affected by its position in the chromosome, with genes located next to heterochromatin often having a mosaic pattern of expression. In 1937, L'Heritier and Teissier demonstrated that mutants of *D. melanogaster* were selected in a frequency-dependent manner in laboratory populations.

Extensive work during the 1940s on *Drosophila* continued to provide advances in our understanding of evolution and fundamental genetics. Auerbach and Robson (1941) discovered that mustard gas induced mutations in *Drosophila*, although they could not publish their results until 1946 because of censorship during World War II. Their discovery opened the field of chemical mutagenesis. In 1944, Dobzhansky described the phylogeny of gene arrangements in the third chromosome of *Drosophila pseudoobscura* and *D. persimilis* and showed that field selection influenced the frequency of these chromosome types. White published his book *Animal Cytology and Evolution* in 1945, in which the cytogenetics of insects (and other animals) were analyzed from an evolutionary point of view. His work illustrated that genomes evolved and highlighted the incredible diversity of insect genetic systems. In 1948, Muller coined the term 'dosage compensation' to describe a phenomenon in which the expression of genes located on the sex chromosomes is made equal in males and females despite the fact that most males have one X chromosome and females have two. Evolutionary studies remained important during the 1950s. Patterson and Stone (1952) published *Evolution in the Genus Drosophila*, which summarized an encyclopedic body of information on the evolution of chromosomes in the genus. In 1956, Kettlewell reported that the peppered moth exhibited industrial melanism and demonstrated that moths that are conspicuous are eaten more often by birds than the inconspicuous moths. This study provided a classic example of natural selection in progress.

In the 1960s gene regulation, the genetic basis of development, and population genetics were investigated using insects. Clever and Karlson (1960) were able to induce specific puffing patterns in the polytene chromosomes of *Chironomus* larvae by injecting the flies with ecdysone, thus demonstrating that hormones were important in gene regulation. In 1961, Beermann showed that the puffing patterns on *Chironomus* polytene chromosomes are inherited in a Mendelian fashion, and Tokunaga demonstrated that the *engrailed* gene of *D. melanogaster* causes a shift from one developmental prepattern to a different, but related, prepattern. In 1962, Ritossa reported that salivary gland chromosomes of *D. buskii* responded to heat shocks by puffing, indicating that environmental stresses could induce puffing (and thus a specific type of gene activity). In 1965, Karlson et al. determined the complete structural configuration of ecdysone and Ritossa and Spiegelman demonstrated that ribosomal RNAs of *Drosophila* are produced in the nucleolus organizer regions of the X and Y chromosomes. Roller et al. (1966) determined the structural formula for the juvenile hormone of *Hyalophora cecropia*. Lewontin and Hubby (1966) revolutionized population studies when they used electrophoretic methods to survey protein variants in natural populations of *Drosophila pseudoobscuraa*. They demonstrated the presence of high levels of variation within populations and opened the field of molecular ecology and evolution. In 1969, Hotta and Benzer and Pak and Grossfield independently induced and characterized neurological mutants in *Drosophila*, providing a new tool for studying neurobiology.

In the 1970s, insects provided answers to various questions. Konopka and Benzer reported the first mutants in *Drosophila* that affected the circadian 'clock', opening a new field in behavior genetics and neurobiology. In 1972, Suzuki and Brown isolated and identified the messenger RNA for silk fibroin from *Bombyx mori*. Kavenoff and Zimm measured the molecular weights of DNA molecules isolated from cells of different *Drosophila* species and concluded that a chromosome contains one long uninterrupted molecule of DNA. Garcia-Bellido and colleagues dissected the development of imaginal wing discs in *Drosophila*. Tissieres et al. (1974) found that heat shocks result in the synthesis of six new proteins in *Drosophila*, even in tissues that do not have polytene chromosomes. This work on heat shock proteins led to a thriving investigation into the cellular responses to stress that remains active today. In 1975, McKenzie et al. isolated messenger RNAs for heat shock proteins and showed that they hybridized to specific puff sites on the *Drosophila* polytene chromosomes.

The 1970s also were significant because genetic engineering began. It is remarkable that in 1975 a group of molecular biologists from around the world met at Asilomar, California to write a historic set of rules to guide research in recombinant DNA experiments. That same year, the National Institutes of Health Recombinant DNA Committee issued guidelines aimed at eliminating or minimizing the potential risks of recombinant DNA research. The first genetic engineering company (Genentech) was formed in 1976. In 1978, Finnegan et al. analyzed dispersed repetitive DNA in *Drosophila*, which was the beginning of extensive studies to understand mutability, transposition, transformation, hybrid dysgenesis, and retroviruses in multicellular organisms. In 1978, Lewis concluded that the component genes in the *bithorax* complex have related functions in *Drosophila* segmentation and that they evolved from a smaller number of ancestral genes by duplication.

During the 1980s, studies on *Drosophila melanogaster* contributed to fundamental advances in understanding the processes of development and gene regulation. The studies initiated by Nusslein-Volhard and Wieschaus in the 1980s are especially notable and their work culminated in a Nobel Prize in Medicine in 1995 for their analyses of the genetic mechanisms that control cell differentiation during embryogenesis and metamorphosis. In 1987, Nusslein-Volhard and colleagues showed that a small group of genes exist in *Drosophila* that determine the anterior—posterior and dorsal--ventral patterns of development of the embryo. These "maternal effect genes" direct the very earliest development of the zygote. In a series of ensuing papers, Nusslein-Volhard and her colleagues provided additional details on the genetics of early embryonic development.

Recombinant DNA research initially was limited to the manipulation of genomes of microorganisms, but that changed in the 1980s when genetic engineering of *Drosophila melanogaster* became possible. Once *D. melanogaster* could be genetically engineered, large numbers of genes could be cloned and details of development studied. This revolution in *Drosophila* genetics was initiated by the discovery in 1982 by Spradling and Rubin that P element vectors could be used to introduce foreign genes into *D. melanogaster* in a repeatable and reliable manner. That breakthrough has led to an explosion of studies on development and gene regulation.

Other revolutionary changes took place in the 1980s. Saiki, Mullis and five colleagues described the use of the polymerase chain reaction (PCR) to allow the amplification of a specific gene. The PCR technique revolutionized molecular biology and ecology and has become one of the most important tools in a biologist's tool kit. Mullis and Smith received the Nobel Prize in Chemistry in 1993 for inventing the polymerase chain reaction and site-directed mutagenesis, respectively.

In the 1990s we learned that many of the genes in *Drosophila* were highly conserved and provided a method to identify genes and developmental processes in other organisms, including mammals. For example, Milicki et al. introduced a homeobox gene from the mouse into *Drosophila* embryos and found that the mouse gene could induce developmental changes in the fly. This implies that genes from animals that have been evolving independently for hundreds of millions of years may generate gene products that function interchangeably. Bargiello and Young had cloned and sequenced the *period* gene in *Drosophila* in 1984, which is the first gene known to control a biological clock. Work on this system continued during the 1990s, and Wheeler et al. were able to introduce the cloned *Drosophila simulans period* gene into the genome of a strain of *D. melanogaster* lacking active *period* genes. The newly-transformed *D. melanogaster* males subsequently could "sing" the *simulans* mating song, which represented an interesting example of a single gene affecting a complex behavior. In 1994, Orr and Sohal constructed transgenic lines of *Drosophila* that have extra copies of the *catalase* and *superoxide dismutase* genes. The new strains aged more slowly, leading to hopes that genetic studies on insects may lead to insights into the fundamental processes involved in aging. Also in 1994, Tully and eight colleagues isolated genes that control the formation of memory in *Drosophila* and opened new avenues to investigate learning. In 1995, Hader et al. demonstrated that the *eyeless* gene in *D. melanogaster* is a master control gene for eye morphogenesis.

Genetic terms are added to the literature on a regular basis. This is the fifth edition of a highly regarded and popular dictionary of genetics. The fourth edition was published in 1990, the third in 1985, the second in 1972, and the first in 1968. The need for new editions has been determined by the rapidity with which the fields of genetics, evolution, and molecular biology change. Even though this dictionary was published in 1997, I was unable to find definitions for the term 'RAPD-PCR' and other variations upon the basic PCR technique. Perhaps these will be found in the sixth edition.

Molecular genetic tools are important to an increasingly broad array of scientific disciplines. This volume will be of interest to anthropologists, chemists, computer specialists, engineers, geneticists, mathematicians, molecular biologists, paleontologists, physicians, physicists, zoologists, and **ENTOMOLOGISTS**, all of whom are using genetic tools to solve interesting basic and applied problems.

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