Genetics Laboratory Investigations (13th Edition)

Thomas L Mertens, Robert L. Hammersmith
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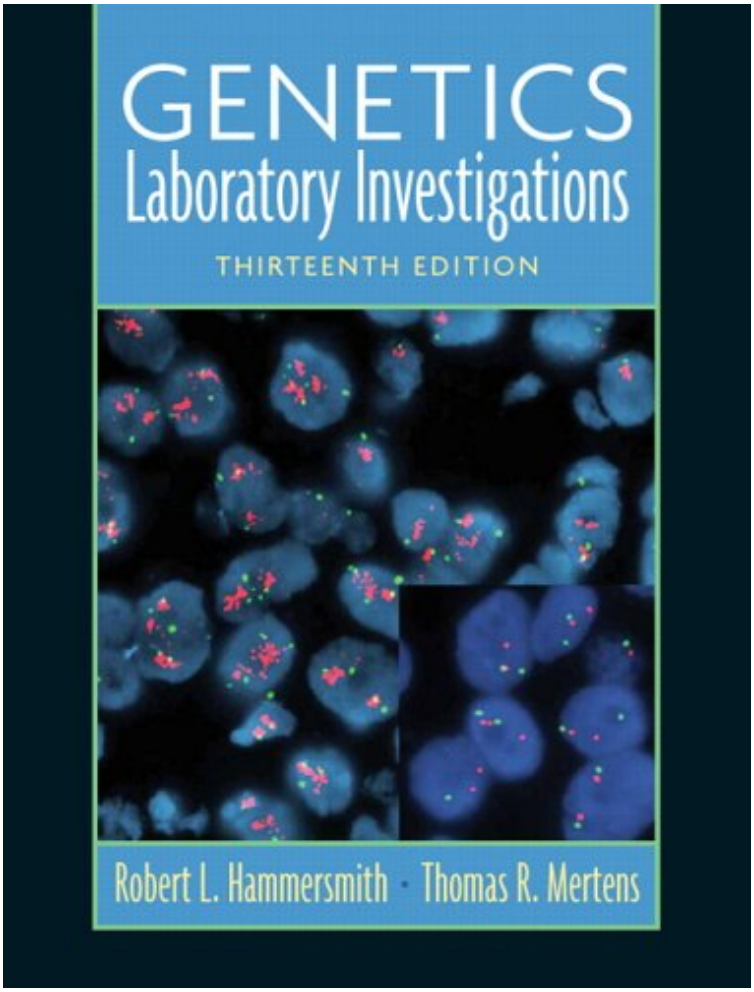

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THE definitive genetics lab manual for over 50 years, this user-friendly volume stresses classical genetics, but includes some of the recent advances related to molecular and human genetics as well. Drosophila and Maize Experiments in Genetics: Monohybrid Crosses; Dihybrid Crosses. Cell Reproduction: Mitosis. Meiosis in Animals: Oogenesis and Spermatogenesis. Meiosis in Angiosperms: Microsporogenesis and Megasporogenesis. Polytene Chromosomes from Drosophila Salivary Glands. Sex Chromosomes and Gene Transmission. The Sex Check: A Study of Sex Chromatin in Human Cells. Human Chromosomes. Linkage and Crossing Over. Genetics of Ascospore Color in Sordaria: An Investigation of Linkage and Crossing Over Using Tetrad Analysis. Open-Ended Experiments Using Drosophila: Locating a Mutant Gene in Its Chromosome. Isolation of DNA. Restriction Endonuclease Digestion and Gel Electrophoresis of DNA. Amplification of DNA Polymorphisms by Polymerase Chain Reaction (PCR) and DNA Fingerprinting. Transformation of Escherichia coli. Gene Action: Synthesis of ... b-Galactosidase in Escherichia coli. Chromatographic Characterization of Drosophila melanogaster Mutants. Bacterial Mutagenesis. Gene Recombination in Phage. Polygenic Inheritance: Fingerprint Ridge Count. Population Genetics: The Hardy-Weinberg Principle; The Effects of Selection and Genetic Drift. Applied Human Genetics. For anyone interested in hands-on genetics work.

From the PublisherPresenting a broad and inclusive array of laboratory investigations, each one self-contained, this manual may be used with any textbook in the field. Building a sound foundation with basic cytological investigations (mitosis, meiosis) and labs on Mendelian genetics and probability, the tenth edition of Genetics Laboratory Investigations goes on to offer more sophisticated investigations in polygenic, population, molecular, and microbial genetics.From the Inside FlapPREFACE The twelfth edition of Genetics Laboratory Investigations will see the fiftieth year that this book has served the needs of genetics instructors and students across the United States and Canada. Beginning in 1952, the first four editions were authored by Eldon Gardner of Utah State University. Thomas Mertens assumed the major responsibility for preparing the next three editions. Robert Hammersmith joined the writing team for the eighth edition; following Dr. Gardner's death, Mertens and Hammersmith prepared editions nine, ten, eleven, and now twelve. This long history of service to the genetics education community was recognized in 1998 by the Text and Academic Authors Association when they presented us with their McGuffey Award. Much of the success of the book can be accounted for by the periodic inclusion of new coauthors who have brought their special expertise to bear on the content, techniques, and philosophy of the book. Beyond that, the book has been designed to be user-friendly and to meet the needs of both faculty and students, having been developed by those actively involved in the teaching of introductory general genetics at the undergraduate level. We are firmly convinced that the student's laboratory experience in genetics is an essential part of the learning process and vitally important to fostering student interest in, and understanding of, the discipline. Toward this end, a number of "open-ended" investigations have been included in this manualthe most obvious being Investigation 14. With appropriate adaptation, however, instructors can use the open-ended approach in any of the investigations in which experimental crosses are made or original (for the student) data are collected. A recent study of the teaching of general genetics in Canadian colleges and universities T. L. Haffie, Y. M. Reitmeier, and D. B. Walden: "Characterization of university-level introductory genetics courses in Canada," Genome 43: 152-159 (2000), revealed that in-so-far as laboratory work is concerned, there was a heavy emphasis on classical transmission genetics in the introductory course. We believe that this is also true in the general genetics courses taught in the United States. In reviews of our book that were completed by the selection team for the McGuffey Award, it was noted that, while the manual stressed classical genetics, provisions had been made to include recent advances related to molecular and human genetics. We have tried to live up to the history of the manual in this new edition. As in previous editions, we have included investigations to accommodate courses taught in a variety of academic settings and to be cost effective especially for investigations involving molecular genetics. Many investigations provide two or more alternative ways of achieving the instructional objectives. Newly designed line drawings in various investigations and new chromosome spreads for karyotyping in Investigation 11 are among the more visible changes. The investigation on restriction enzyme analysis also has been expanded and new photographs added to enhance student understanding. References at the end of each investigation have been reviewed and updated sources added. Problem sets in Investigations 3, 4 and 23 have been redone. A new Instructor's Manual provides answers to most questions in each investigation, helpful hints for setting up experiments in certain investigations and, when needed, sources of instructional materials beyond those suggested in the book itself. The cover of the book is also useful in the instructional process. The photograph of a "painted" human leucocyte chromosome preparation on the cover is useful in assisting students to understand how molecular techniques for differential visualization of chromosomes can be helpful in analyzing complex chromosome rearrangements at the cytogenetic level (see Investigation 12). To all who have assisted us over the years, we give our thanks. Credit for illustrations and tables in the present edition are given with appropriate investigations according to the wishes of the authors or publishers from whom permissions have been granted. Investigations 13 (genetics of Sordaria), 23 (human fingerprint ridge counts), and 25 (genetic drift) were originally published in The American Biology Teacher, the first in May, 1968, the second in April, 1989, and the third in November, 1990. We are indebted to Dr. George Hudock of Indiana University for permission to modify two investigations included in his book, Experiments in Modern Genetics (John Wiley Sons,

1967). These modifications of Hudock's work appear as our Investigations 19 and 22. We acknowledge with special appreciation new photos of human chromosome spreads (Investigation 11) and the cover photograph provided by Dr. Daniel L. Van Dyke and his colleagues A. Wiktor and J. Zabawski, Department of Medical Genetics, Henry Ford Health System, Detroit, Michigan. Thanks are also due to Dr. Kenneth Weber of the University of Southern Maine for supplying the photograph of mitotic chromosomes showing sister chromatid exchanges (Investigation 5). We thank Carolina Biological Supply Company (Investigation 6), the Biological Sciences Curriculum Study (Investigation 23), and Helena Laboratories (Investigation 26) for illustrations they provided. The section of Investigation 26 that deals with electrophoresis of hemoglobin has been reviewed by Helena Laboratories of Beaumont, Texas, and is used with their permission. Investigation 17 is based in part on material supplied by the Perkin Elmer Corporation and by Carolina Biological Supply Company, and thanks are due to both firms for their assistance. Kits for conducting this investigation may be purchased from either company. We wish to thank our editor, Sheri Snavely, and her staff for their support and efforts in the production of this manual. Finally, we wish to thank the instructors and students who have used the eleventh edition of this manual. It is their commitment to the manual that has justified the production of the twelfth edition. We hope that the updating and additions found in the new edition will continue to make the manual a useful instructional tool.T. R. M. R. L. H.From the Back CoverTHE definitive genetics lab manual for over 50 years, this user-friendly volume stresses classical genetics, but includes some of the recent advances related to molecular and human genetics as well. Drosophila and Maize Experiments in Genetics: Monohybrid Crosses; Dihybrid Crosses. Cell Reproduction: Mitosis. Meiosis in Animals: Oogenesis and Spermatogenesis. Meiosis in Angiosperms: Microsporogenesis and Megasporogenesis. Polytene Chromosomes from Drosophila Salivary Glands. Sex Chromosomes and Gene Transmission. The Sex Check: A Study of Sex Chromatin in Human Cells. Human Chromosomes. Linkage and Crossing Over. Genetics of Ascospore Color in Sordaria: An Investigation of Linkage and Crossing Over Using Tetrad Analysis. Open-Ended Experiments Using Drosophila: Locating a Mutant Gene in Its Chromosome. Isolation of DNA. Restriction Endonuclease Digestion and Gel Electrophoresis of DNA. Amplification of DNA Polymorphisms by Polymerase Chain Reaction (PCR) and DNA Fingerprinting. Transformation of Escherichia coli. Gene Action: Synthesis of ... b-Galactosidase in Escherichia coli. Chromatographic Characterization of Drosophila melanogaster Mutants. Bacterial Mutagenesis. Gene Recombination in Phage. Polygenic Inheritance: Fingerprint Ridge Count. Population Genetics: The Hardy-Weinberg Principle; The Effects of Selection and Genetic Drift. Applied Human Genetics.