The Awesome Power of Genetics Education

Review of: *Genetic Techniques for Biological Research: A Case Study Approach*, by Corrine A. Michels, 2002; 241 pp., John Wiley & Sons (Chichester, England); ISBN: 0-471-89919-4; <http://www.wileyurope.com>

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Each of us teaching advanced courses in genetics has our favorite set of papers to illustrate particular strategies and approaches. Of necessity, these lists tend to be somewhat idiosyncratic and biased, possibly favoring those fields we know best, but also missing the best exemplars from other fields. To find the right balance, we often trade the titles of our favorite papers like baseball cards, striving for an overall lineup that is neither too old and dated nor too recent and superficial. Several texts provide guides to the bacterial genetics literature, but until now, none have taken on the recent developments in yeast genetics. With *Genetic Techniques for Biological Research: A Case Study Approach*, Corrine Michels has done an admirable job, providing not only her favorite lineups, but also detailed background material and guides to each player.

The book is built in three parts. The first provides essential background material about the model organism that is central to this book, the yeast *Saccharomyces cerevisiae*. Beginning with the basic facts of the life cycle and modes of inheritance, the introductory material moves on to describe basic cell and molecular biological techniques as they apply to yeast. The introductory material is completed with descriptions of some of the best-characterized cell biological processes, such as mating and secretion, which form the basis of later discussion. Although advanced students already familiar with the organism may skip the introductory sections, they provide a very valuable basic review of the organism.

If yeast has become (arguably) the preeminent model eukaryotic organism it is because of what is often referred to as the “awesome power of yeast genetics” (APOYG). The second section of the book provides an overview of the various classical and modern molecular genetic techniques that constitute APOYG. Some of the most useful parts of this section deal with the basic practical considerations that often get left out of textbooks. For example, Michels describes some of the considerations that govern the isolation of mutants by screens or selections and their subsequent analysis by complementation analysis and genetic mapping. While not a recipe book, a thoughtful student should get important tips about how to approach mutant isolation in their own favorite system. Indeed, I think it would have been useful to include more along these lines, such as the importance of establishing and

maintaining the independence of different mutant isolates. Included in this section are descriptions of all of the modes of genetic interactions (suppression, enhancement, epistasis, synthetic phenotypes, two-hybrid) from both theoretical and practical perspectives.

I particularly appreciated the inclusion of explanations for the basis of different modes of suppression and enhancement. As these often form the hypothesis that is the basis of the next experiment it is important that these be clear to the students. One may question the validity of the model for “in-pathway enhancement,” in which leaky mutations at different steps in the same pathway combine to produce a stronger defect (how can there be two rate limiting steps in the same process?). Nevertheless, this is a concern that is often raised about certain kinds of interactions and therefore should be included.

The most useful and novel section of *Genetic Techniques* are the case studies, extensive and detailed guides to the literature in four major areas of modern yeast genetics: “Glucose Regulation and Signaling,” “Secretion,” “The Cell Division Cycle” and the “The Mating Pheromone Response.” For each major area, references are provided for a set of 18 or so papers that illustrate particularly strong and compelling examples for some of the major steps taken within each field. The papers have been assembled in more or less historical order and so we see the full batting-order cycle through: each one a star, each one hitting a home run. It is quite wonderful to see the logical and experimental progression, from the initial isolation of the mutations, followed by the determination of the numbers of the genes (complementation analysis), their identification (gene isolation), and their placement into pathways by the analysis of the ever-widening network of genetic interactions. Michels’ choices are clear and logical and beautifully illustrate how each paper builds upon the previous one, a compelling demonstration of the mode and tempo of scientific progress. By staying within the framework of a larger overall topic, students do not have to learn an entirely new system as each new method is introduced. Any of us might choose a few alternate players, depending on our tastes, but the presence of each paper is easily defensible. For each of the chosen papers, Michels provides a brief guide to the overall context of the paper and the major findings and follows that with a list of study questions to guide the students understanding of the paper. These are generally quite thoughtful and detailed and could be used for self-study or as part of an advanced course.

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Who is the intended audience for this book? It seems ideally suited to advanced undergraduates, who have already taken an introductory survey course in genetics and who are now beginning to read the primary literature. It will also be very useful for beginning graduate students, specializing in yeast, who are both trying to learn experimental strategies for working with yeast and learning the classics of the canonical literature. Finally, I would recommend it to more senior researchers who want a short survey of the yeast, as well a list of some of the important early papers.

The weaknesses of the book are relatively minor. There are several examples of non-standard usage (e.g., the use of the

word auxotrope for auxotroph). The reviews of the different methods and fields are necessarily brief and not necessarily either the most scholarly or the most critical. Finally, some of the papers have clearly been chosen for pedagogical reasons and not for completeness. However, this is really quibbling, because in the context of a course these considerations must be secondary to the needs of the students.

Hopefully, for the readers of this book, this will mark only the beginning of their own long season in modern genetics. The aim of every teacher is to inspire students to move down from the stands, step up to the plate, and start hitting on their own. This book is a wonderful tool to help in that quest.