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Book Review

Phage Display in Biotechnology and Drug Discovery, S. S. Sidhu, CRC Press, Taylor and Francis Group, Boca Raton, Florida, 2005, Hardback, 748 pages, ISBN: 0824754662

It is about 20 years now since it was first shown that genetic fusion of a peptide to a filamentous phage coat protein results in presentation of the peptide at the surface of the viral particle (Smith, 1985). From that seminal observation, an extraordinarily powerful and versatile phage display technology has developed, enabling the selection of novel binding functions from large populations of randomly generated peptide sequence variants. A phage display library is a huge collection of individual phage clones, each displaying on its surface a peptide with a different amino acid sequence. From a sufficiently complex library, phage bearing peptides with practically any desired binding activity can be physically isolated by affinity selection. Moreover, since each particle carries in its genome the genetic information for its own (and for its guest peptide's) replication, the selectants can be amplified in bacteria, subjected to additional rounds of selection as needed, and ultimately characterized in great detail using molecular biology methods. By thus mimicking the inventive power of evolution, phage display can find solutions to problems we are not yet smart enough to solve by design.

Phage Display in Biotechnology and Drug Discovery is the latest addition to an already extensive literature on the subject. Its seventeen chapters, each authored by experts in the field, cover the broad scope of the technology, from its foundations to some of its most specialized elaborations. The volume begins with four highly informative introductory chapters that, assuming basic competence in molecular biology, prepare even the uninitiated to understand the molecular basis of phage display. An extensive introduction to filamentous phage structure and molecular biology explains the logic of display, and enables an appreciation both of its power and of its limitations. This is followed by an introduction to the main classes of filamentous phage vectors, and the various configurations in which foreign peptides and proteins can be presented at the virus surface. Chapters treating library construction methods and strategies for selection and screening round out these introductory materials. Surprisingly diverse functions can be found in libraries of even relatively small peptides, and five chapters are devoted to describing their uses in the selection of diagnostic reagents and vaccine candidates, in the identification of the substrates of enzymes that act on protein targets, for mapping sites of protein–protein interaction, and for isolation of peptides useful in high throughput drug screens. The second half of the book deals with applications that depend on display of whole protein domains, including antibodies. It presents methods for selection of stably folded proteins and new protein catalysts, it describes the use of *c*DNA library display for identification of protein–protein interaction partners, and shows how phage display can facilitate the mutational dissection of protein functional epitopes. Fully four chapters are devoted to showing how antibody display can serve as a powerful nontraditional route to new antibodies with useful properties. Subjects such as antibody humanization, affinity maturation, and selection of specific antibodies from immune, non-immune and synthetic sources are all treated here in considerable detail.

This is a lot of ground to cover, but *Phage Display in Biotechnology and Drug Dscovery* covers it admirably. Of course, the book does not cover everything; no one book on so large a subject reasonably could. Absent, for example, is any discussion of display systems derived from nonfilamentous phages. And this is not a laboratory manual; anyone seeking a

collection of detailed protocols had better look elsewhere. However, I am unaware of another volume that offers so comprehensive a treatment of the fundamental basis of filamentous phage display, of its capabilities and limitations, and of the experimental considerations important in its application. Anyone with serious interests in the phage display technology will find this a valuable addition to his reference library.

REFERENCE

Smith, G. P. (1985). Filamentous fusion phage: novel expression vectors that display cloned antigens on the virion surface. *Science, 228*, 1315–1317.

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