

Book Review

Pharmaceutical Dissolution Testing, **edited by** **Jennifer Dressman (Johann Wolfgang Goether Univ., Frankfurt, Germany)** **and Johannes Krämer (Phast GmbH, Hamburg/Saar, Germany),** **published by Taylor & Francis Group, Boca Raton, FL** **ISBN 0-8427-5467-0**

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I happen to believe that the topic of dissolution is not taught rigorously in undergraduate colleges. It is taught mainly in pharmacy schools, but very rarely in chemistry departments. Consequently, chemists that obtain employment in the pharmaceutical industry lack the necessary background and have to learn dissolution testing on the job. This is unfortunate because dissolution is one of the most critical tests that are performed in order to establish the quality of the dosage forms. Dissolution testing provides assurance that the dosage form disintegrates and de-aggregates, and the drug gets liberated and becomes available in solution at the site of absorption. It is, perhaps, the most important test from the perspective of a patient. Therefore, training students and pharmaceutical analysts in dissolution is a worthwhile investment. This new book edited by Jennifer Dressman and Johannes Kraemer is a welcome arrival and will be very helpful in training dissolution scientists.

The book comprises 14 chapters. I started reading the first chapter (about 30 pages) entitled "Historical Development of Dissolution testing" and found it to be very insightful. Dr. Tim Grady, one of the co-authors, has participated in the early evolution and growth of dissolution testing during his long and highly successful career at the USP. His insight on the historical perspective is quite interesting and invaluable. The authors explain that the dissolution test was mainly developed because of the inadequacy of the disintegration test. They also rightly point out that "like disintegration testing, dissolution tests do not prove conclusively that the dosage form will release the drug in vivo in a specific manner, but dissolution does come one step closer. ..." The chapter provides an accurate insight into the early collaborative work that was performed primarily between USP and FDA in order to identify methodologies,

equipment, specifications, and all the issues that a new technique encounters. The authors have also provided a comprehensive account of the early steps that were taken to standardize the test so that the variability in results could be minimized. The effort of Dr. Bill Hanson in standardizing equipment is recognized. It is also a good chapter to read if inquiring minds want to know such things as why basket apparatus became official before paddle apparatus, why multiple calibrator tablets are used to establish equipment suitability, and so forth. It was difficult for me to not go back and read the chapter again. I think other readers will enjoy it, too.

The next three chapters deal with the compendial and regulatory aspects of the dissolution test. The second chapter is entitled "Compendial Testing Equipment: Calibration, Qualification, and Sources of Error" written by Vivian Gray. The chapter contains a good description of all compendial equipment. It provides useful information that can be applied to performing a successful calibration of compendial equipment. The role of calibrator tablets is described as a test of the dissolution system that provides assurance that the system is suitable for intended use. The chapter has many hints and useful remedies that can be used in overcoming errors during equipment calibration. Chapter 3, written by William Brown, who is a current liaison at the USP for the Biopharmaceutics Expert Committee, contains information about the role of the major pharmacopeias, viz., USP, BP, JP, and EP. The main function of a pharmacopeia is to provide a uniform and public basis on which to evaluate therapeutic products that are used in the practice of medicine and pharmacy. Ingredients and products that fall short of these specifications can be judged unsuitable for use. The author does a good job of giving a comparative evaluation of the dissolution test in the major

pharmacopeias. The history of the pharmacopeias, their role, comparative differences, and the attempts to harmonize the pharmacopeias are other topics that a reader will find interesting.

Chapter 4 deals with the topic of the role of dissolution in the regulation of pharmaceuticals. The author of this chapter is Vinod Shah, who has played a very active and important role in the development of industry guidances while working at the U.S. Food and Drug Administration (CDER). The chapter gives an overview of the FDA guidances that utilize dissolution in justifying pre- or post-approval manufacturing changes and in applying for bio-waivers on the basis of BCS system. The section on dissolution profile comparison is very clear and concise. The author points out that these guidances have increased our reliance on the dissolution test, and it is to be expected that dissolution will continue to play a vital role in assessing both pharmaceutical as well as biopharmaceutical aspects of dosage forms.

In Chapter 5, Clive Wilson and Kilian Kelly provide an overview of the various aspects of the role of GI transit in drug absorption. This knowledge was gathered mainly from the application of modern investigative tools such as MRI, gamma scintigraphy, and magnetic moment imaging. The chapter deals with the practical aspects such as the effect of gastric emptying and transit time on drug delivery and absorption. It is useful information for entry-level formulators and analytical chemists and serves as a good reference for those who are more experienced in the area of drug delivery. Chapter 6, entitled "Physiological Parameters Relevant to Dissolution Testing: Hydrodynamic Consideration" by Steffen Diebold, is well written. This can be a difficult topic, but the author has done a good job of explaining the concepts in a clear and concise manner. The author highlights the fact that dissolution is a hydrodynamics-dependant process. Therefore, in order to control the variability in dissolution testing, one must understand how to maintain steady hydrodynamic conditions during the test. The chapter is a good reference for concepts such as Reynolds numbers, flow patterns (laminar to turbulent flow), the role of diffusion boundary layer, and also hydrodynamics in the GI.

Chapter 7, written by Jennifer Dressman et al., is entitled "Development of Dissolution Test on the Basis of Gastrointestinal Physiology." It provides logical, systematic, and scientifically sound strategies for the development of disso-

lution methods. The main focus of the chapter is on the proper selection of the media. The authors write, "This is not a trivial question, since the outcome of the test can be greatly dependent on the dissolution medium, especially if the drug itself and/or key excipients are poorly soluble and/or ionizable." I particularly like the strategy in which drugs are classified on the basis of solubility. For high solubility drugs, a simple test could be developed using buffer at pH 6.8 instead of acidic medium. Several good reasons for using the higher pH are presented, most importantly the fact that the gastric pH varies significantly in different individuals and populations. Also, some drugs may not be as stable in acidic medium. Finally, the strategy for using biorelevant media in dissolution testing is very well explained.

The next three chapters provide good background on the theory and modeling of in vitro–in vivo correlations, study design, and interpretation of in vitro–in vivo data. In Chapter 11, Johannes Kraemer et al. look at the dissolution test as a test of quality control. The chapter describes strategies for the development of dissolution methods, taking advantage of the regulatory guidances and pharmacopeial chapters. In Chapter 12, Cynthia Brown provides dissolution method development strategies from an industrial perspective. The author emphasizes that dissolution methods not only assess quality of the product but also play a big role in the characterization of formulations during product development. The next chapter by Dale VonBeheren and Stephen Dobro is entitled "Design and Qualification of Automated Dissolution Systems." The chapter is concise and the authors discuss different aspects of dissolution automation including the rationale for extent of automation, regulatory considerations, 21CFR11 compliance, equipment qualification, and maintenance. In the last chapter, V. Srinivasan describes the role of dissolution in the assessment of bioavailability of ingredients in dietary supplements.

The main aim of the authors was to write and edit a book covering all the aspects of dissolution utilizing experts from the entire international arena. I believe that the book certainly meets the objective. In conclusion, the book is a useful addition both as a text book for teaching new dissolution scientists and as a reference book for all practitioners of dissolution.

[Note: This book may be purchased at www.dissolutiontech.com.]