

# STEREOLOGY FOR STATISTICIANS

BADDELEY A, VEDEL JENSEN EB 2005. Chapman & Hall/CRC, Boca Raton. 395 pages.  
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The book *Stereology for Statisticians* sets out the basic principles of stereology from a statistical point of view, focusing on both basic theory and practical implications. It's a comprehensive source of information for life sciences statisticians and statistical consultants to give advice to their research collaborators and clients about experiments that involve stereology. This textbook discusses several ways to effectively communicate statistical issues to clients, draws attention to common methodological errors, and provides references to essential literature. The book focuses mainly on design-based stereology (model based approach is also treated in some chapters) and can serve as the textbook for a course on stereology for students of statistics. On the other hand, the book can be a valuable source of statistical concepts for practitioners in stereology wishing to understand the statistical background of methods used in stereology.

The book is divided into 14 chapters. The first few chapters give an introduction to classical and modern stereology and are followed with a methodological overview of geometrical identities and statistical prerequisites. Next, the core techniques of stereology, such as the estimation of 'absolute' and 'relative' geometrical quantities using different designs, are presented. The final chapters discuss implementation and problems. An appendix, covering essential background on sampling theory is followed by the useful *List of notations* and extensive *References* sections. Each chapter starts with a short overview and ends with practical and theoretical exercises and bibliographic notes. Many chapters include the *Advice to consultants* section.

The first two chapters, *Classical stereology* and *Overview of modern stereology*, give an overview of historical development of stereology and describe the basics of stereological problems and solutions. They are a good introduction to the practical side of the field for statisticians and to the mathematical notation for practitioners.

The next chapter, *Geometrical identities*, gives formal definitions of geometrical objects and their relations in 3-dimensional space. It is followed by *Geometrical probability*, in which the concepts of probability are interpreted in the stereological framework. The description of geometrical and statistical prerequisites is completed in *Statistical formulations of stereology*, in which the general template for a statistical model of stereological experiment, developed principally by Miles, Cruz-Orive, and Weibel is described.

The following chapters present the core techniques of stereology. The estimation of 'absolute' geometrical quantities, such as volume and surface area, using isotropic uniform design (*Uniform and isotropic uniform designs*), and vertical or local designs (*Vertical and local designs*). The estimation of 'relative' quantities such as volume fraction is described in chapter *Ratio estimation*. The statistical inference and sampling for a population of discrete objects, such as cells or mineral particles are covered in next two chapters (*Discrete sampling and counting* and *Inference for particle populations*). In the next chapter, *Design of stereological experiments*, the reader will find useful description of strategies for designing and implementation of stereological experiments. Chapter, *Variance of stereological estimators*, presents theoretical solutions with the variance of stereological estimators and describes practical techniques for estimating the variance from sample data. In the last chapter, *Frontiers and open problems*, some current research issues in stereology for further statistical research are presented. Some key concepts of survey sampling theory are presented in *Appendix*. The concepts and explanations in the book are illustrated with more than 150 figures. Of a special value is the list of more than 600 references.

The book is written in a practical, applications-oriented approach with a combination of statistical formalism. The authors claim that only a basic understanding of undergraduate statistical concepts is necessary for the reader, but the developed statistical concepts are far from trivial. *Stereology for statisticians* will certainly be of interest to anyone involved with statistical analysis in life sciences; practitioners in stereology will find an overview of statistical principles of modern stereology with a

focus on design-based stereology while statisticians will get an insight into the practical side of stereology and use of statistical theory in stereology.

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