QUANTITATIVE METHODS IN NEUROSCIENCE. A NEUROANATOMICAL APPROACH

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Quantitative Methods in Neuroscience is a book I personally wish I had a long time ago. In my research endeavours I have often come across problems where I felt I was missing specific neurostereological and statistical knowledge to tackle the problems successfully. I looked for ways to acquire the missing information, and found out that most published sources provided relatively user-unfriendly mathematical methods, which one still needs to modify to apply appropriately to individual specific problem at hand. Doing so requires not only common sense but a good dose of knowledge of applicative stereology and statistics. That is where the strength of this book lies. It provides the reader with the explanations of basic theory as well as offering examples of its implementation in the context of a number of specific neuroscientific research problems. In the editors' own words, the book is not meant as a reference source for stereologists but rather serves as a "cookbook of stereological methods for neuroscientists".

The book is divided into sections, preceded by an excellent General introduction, which offers a comprehensive overview of the essence of stereology applied to neuroscientific problems. Following it is a sample Case study from neuroscience involving stereology and multivariate analysis, which takes the reader step by step through a study, laying out and discussing the statistical and stereological options and justifying the use of certain solutions. The book is then further divided into 5 sections dealing with "Number", "Volume", "Length and surface", "Second order stereology" and "Cell culture". The first three sections have their respective introductory chapters, addressing the key theoretical issues in determining numbers, volumes, lengths and surface areas in histological samples. The titles of individual chapters shed more light on the editorial strategy in assembling the volume by resolving some major types of basic neuroscience problems: Use of fluorescent probes in cell-counting procedures, Counting in situ hybridized neurons, Number in electron microscopy: estimation of total number of synapses in the main regions of the human neocortex, The number of microvessels estimated by an unbiased stereological method applied in a brain region, The nucleator and the planar and optical rotators applied in rat dorsal root ganglia, Estimation of number and volume of immunohistochemically stained neurons in complex brain regions, Length estimation of nerve fibers in human white matter using isotropic uniformly random sections, Spatial distribution and Unbiased morphometrical techniques for the quantitative assessment of cells in primary dissociation culture.

The essence of stereology is the principle of random and systematic sampling. In the recent decades, the increased rigor achieved in applying stereological methods, has lead to new standars for experimentation (Kordower, 2000). On the other hand, many researchers still shy from using stereological methods in quantifying neuroanatomical data. Many scientists find stereology too expensive, due to specialized and costly equipment, others are discouraged because the use of stereological principles in counting for example is still neither faster nor easier than manual counting. Finally, lack of knowledge regarding the best approach in a given research situation additionally hampered the use of appropriate quantifying techniques. However, it is the responsibility of the scientist to collect and disseminate scientific data in the most accurate way possible (Kordower, 2000). Thus a good set of guidelines, as provided by Quantitative Methods in Neuroscience should prove useful in facilitating the use of appropriate methods. It is worth mentioning, however, that it is also quite crucial that the scientist be aware when not to use streology: the editors warn the readers of the danger in quantifying things indiscriminately, counting and measuring them for the sake of numbers in situations where the biological effect is clear just from simple observation of the material.

The chapters in the book are writen by the leading scientists in the field, who offer an overview of the basic stereological background and the application to selected, frequently encountered problems in neuroscience. They deliberately take a "gentle" approach, limiting the amount of formulae and in depth discussion of stereological theory, obviating some of the mathematical rigor for the sake of simplified,

user-friendly description of the methods. Adequate references are provided for those, who wish to pursue detailed mathematical discussion on stereology. The authors also take the "cookbook approach" seriously, often offering specific details of material preparation (*e.g.*, including a detailed recipe for mixing a time-tested coverslipping solution for immunofluorescence, complete with catalogue numbers of individual key component substances).

All in all, this is a well written set of specific examples of the application of stereology to frequent neuroscientific research problems. Given the limits of such design, where some possible questions unavoidably stay unanswered, the compilation provides a wealth of useful general information, and specific instructions for proper procedures in a good number of situations.

REFERENCE

Kordower JH (2000). Making the counts count: the stereology revolution. J Chem Neuroanat 20:1-2.

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