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BOOK REVIEW

QSPR/QSAR Studies by Molecular Descriptors

by

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Nova Science Publishers, Huntington, New York, 2001, VIII+438 pp.

This book is a collection of articles, written by different authors, all devoted to various aspects of molecular descriptors and their applications by means of *quantitative structure-property relations* (QSPR) and *quantitative structure-activity relations* (QSAR). As usual, under "property" is understood some physico-chemical property of organic compounds whereas under "activity" some of their pharmacologic or biological activity.

Research along these lines started around the middle of the last century (although some of its roots go much deeper in the past). Initially this research was a marginal branch of theoretical chemistry, accepted with contempt by the majority of peers. As time passed, QSPR/QSAR became more and more popular because it proved to be useful, not so much in "pure" physical chemistry, as in pharmacology (drug design), medicinal chemistry, agrochemistry, environmental sciences, ... In the most recent times there already are QSPR/QSAR studies of great industrial and commercial value.

The optimism and self-confidence of the present-day scholars may be illustrated by the words of Lionello Pogliani, who, speaking of the molecular connectivity theory (in Chapter 6), maintains that "*this theory shows the characteristic of completeness. It is, in fact, possible to describe known properties or activities of molecules, and also, from desired properties or activities revert back to the corresponding molecule.*" In Pogliani's work molecular properties such as "*the solubility, the side chain molecular volume, the crystal densities, and the specific rotations of L-amino acids, the average pK values, and the solubility of purines and pyrimidines, five different properties of DNA–RNA bases, the melting points and motor octane number of alkanes, the lattice enthalpies of metal halides, the unfrozen water content of a heterogeneous class of amino acids and inorganic salts, the molar refractivities, the retention index, the refractivity, and the density of organic phosphoderivatives, the boiling and melting points, the density, the refractive index, and the dielectric constant of a wide heterogeneous class of organic solvents*" are successfully modeled.

The increase of interest in QSPR/QSAR is paralleled by the publication of numerous books in this area. Of the most recent such books, at least, "*From Chemical Topology to Three Dimensional Geometry*" (edited by Balaban, 1997), "*Molecular Topology*" (by Diudea and Ivanciuc, in Romanian language, 1998), "*Topological Indices and Related Descriptors in QSAR and QSPR*" (edited by Devillers and Balaban, 1999) and "*Handbook of Molecular Descriptors*" (by Todeschini and Consonni, 2000) should be mentioned. Diudea's "*QSPR/QSAR Studies*" is the newest in this series; however, this reviewer knows of two more books on QSPR/QSAR and topological indices that are expected to appear in the nearest future. The mentioned books necessarily overlap to some extent with each other, but each of them offers something new to the respective field of research. Those who can afford, should acquire all these books. Those who can't will not lose much if they restrict their purchase to one or two titles.

Diudea's "*QSPR/QSAR Studies*" contains twelve chapters. Their titles are given here in an abbreviated form:

1. "*A Personal View about Topological Indices*" by Balaban
2. "*Wiener-Type Graph Invariants*" by Lukovits
3. "*Molecular Descriptors Based on Graphical Bond Orders*" by Plavšić and Graovac

4. "*Modeling the Solubility of Aliphatic Alcohols*" by Nikolić et al.
5. "*QSPR/QSAR by Graph Descriptors*" by Estrada and Molina
6. "*The Graph Mass in Molecular Graph Theory*" by Pogliani
7. "*Eigenvalues as Molecular Descriptors*" by Randić et al.
8. "*Neural Networks for Structure-Property Models*" by Ivanciuc
9. "*3D QSAR Models*" by Ivanciuc
10. "*Van der Waals Molecular Descriptors*" by Ciubotariu et al.
11. "*Applications of the TI-MTD Model*" by Minailiuc and Diudea
12. "*Automated Comparative Analysis of Pharmacophoric Patterns*" by Horvath

There is a total of 23 authors. Of these 8 are from Romania (or of Romanian origin) and 9 from the countries formed after the fragmentation of former Yugoslavia. This probably reflects the circles of scientists with whom the editor is on good terms.

The book gives a state-of-the-art profile of the research of molecular descriptors and their applications. Roughly speaking, the first half of the book is devoted to graph-based topological indices (including 3-dimensional, Chapter 9), the second half to applications (mainly in pharmacology).

In this reviewer's opinion two chapters are of especially high quality: Chapters 1 and 7.

In Chapter 1 Alexandru T. Balaban, one of the founders of chemical graph theory (around 1970) and one of the most influential and prolific authors in this field ever since, gives a concise, but clear and rather informative "personal" account of the theory of topological indices, including their classification into four "generations". This deserves to become an obligatory reading for every graduate student of theoretical organic chemistry and every scholar intending to use topological indices in his or her research.

The title of Chapter 7 (written by Milan Randić and two of his younger coauthors from Slovenia: Marjan Vračko and Marjana Novič) is to some extent misleading. It is true that this chapter deals with a few graph-eigenvalue-based structure-descriptors, but - in addition - there are considerations of much wider importance. First of all, in the introduction are stated and discussed Balaban's *Six Commandments* and

Randić's *Thirteen Commandments*, namely the 6+13 conditions which a graph invariant is required to obey in order to be acceptable as a molecular structure-descriptor. Somewhere in the middle of this chapter we find a section "*On the Interpretation of Molecular Descriptors*" in which one of the most fundamental problems of the entire chemical graph theory is discussed. Therefore, Chapter 7 is recommended also to those who have no interest in using matrix and graph eigenvalues as structure-descriptors.

Space limitation does not allow us to survey all the interesting topics discussed in Diudea's book. We, nevertheless, must mention the recently developed calculation schemes, directly applicable to real-world problems of chemistry and pharmacology, that are presented in due detail in Chapters 5, 10, 11 and 12.

In Chapter 5 the computer systems *MODEST* (acronym derived from: MOlecular DESign Tool) and *TOSS-MODE* (from: TOpological SubSt.uctural MOlecular DEsign) are presented. Chapters 10 and 11 describe the *MSD* (= Minimal Steric Difference) method and its graph-based version, the *TI-MTD* (= Topological Index - Minimal Topological Difference) model. In Chapter 12 we learn about *CoMFA* (= Comparative Molecular Field Analysis) and *ComPharm*, which is a simplified version of the *CoMFA* approach, suitable for pharmacologic studies. In each of these chapters a large number of examples and applications is presented.

If something is weak in Diudea's book, this is the short Chapter 2, devoted to distance-based topological indices. It is written by an expert in this field, who – unfortunately – produced a routine and unmotivated text, inferior to other similar reports available elsewhere.

Each chapter in the book has an extensive list of references, which gives them an additional value. Over 1000 bibliographic units are quoted (of these 200 by Balaban and 180 by Randić et al).

In summary, "*QSPR/QSAR Studies by Molecular Descriptors*" is a valuable and comprehensive monograph and is recommended to all who do or intend to do research of, and who make or intend to make money by means of QSPR/QSAR.

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