

## BOOK REVIEWS

### **Perspectives in Environmental Health – Vector and Water-Borne Diseases.**

Aniruddha Mukhopadhyay and Amit Krishna De (eds). Publishers Originals, A-6, Nimri Commercial Centre, Near Ashok Vihar, Phase IV, Delhi 110 052. pp. 243. Price: Rs 250.

Story of life on earth is one of a constant effort at matching the environment. It is this constant interaction that has governed the evolutionary process from the simplest form that developed in the 'primordial soup' to the present diversity. Major shifts in the sum total of environmental factors have had dramatic effects on the flora and fauna prevalent at that moment. The pre-Cambrian species loss and rapid decimation of dinosaurs are outstanding events that marked changes in evolutionary directions. The development of life in inhospitable situations has emphasized the versatility of the life processes. Living beings are in a state of flux and their processes of growth and sustenance bring them in contact with each other, with deleterious effects to some.

Parasitism as a life style has been adopted by many life forms, probably most successfully by bacteria and viruses. The ideal state of 'no adverse effect' to the host is achieved only when the host/parasite association has stabilized. Short of this, the parasite does cause disease and becomes a pathogen. The survival of a pathogen depends on its ability to exist in the *in vivo* environment and ensure its transmission to another host. Transmission has evolved along environmental routes. Thus, special adaptations have evolved for transmission by air, water, contact, etc. The most ingenious method of spread has been evolved by pathogens that use vectors to ensure their survival. The simplest mechanism is passive introduction as seen in louse-borne typhus or Chagas' disease. Other pathogens have developed complex life cycles using the vector bodies as amplifiers and areas of genetic diversity. This is clearly seen in the life cycle of the malarial parasite which uses its transit in the mosquito for sexual reproduction and amplification of numbers.

Thus, the course of life is directed by a sum total of animate and inanimate influences. The human species is unique in consciously modifying the environment to suit itself. This however can have unforeseen consequences that sometimes become counterproductive. Human activity has been able to affect all aspects of

the environment, the collateral results due to changes in the biosphere are often unpredictable.

The book under review looks at two aspects of the environmental effects, viz. vector and water-borne diseases. The title suggests an extended series but apparently it is a stand-alone volume.

The vector-borne diseases part of the volume is a collection of individual presentations without an attempt to ensure continued development of a theme. Malaria occupies the pride of place with eight papers covering diverse topics from history to remote sensing.

The opening chapter is a short review of the arthropod vectors that are of human and animal interest. The author has managed to give a fair amount of information within a few pages. Three chapters cover the results of studies in Kolkata and West Bengal surveying the status of malaria and vectors. The works presented in the papers were carried out in the mid-1990s up to 2000. Nevertheless they would be useful data for evaluating later results. One of the surveys covers a larger ground and prescribes an overall strategy for control of malaria. An interesting article reviews the unsatisfactory status of mosquito-borne infections. While the article rings a despondent note, it makes a case for the involvement of entomologists in the control of vector population, recollecting the statement, 'the National Malaria Eradication Project did not eradicate malaria but succeeded in eradicating malariologists!'

Two chapters deal with the clinical features and therapeutics. The chapter on clinical features is quite exhaustive and reviews the symptomatology and drugs. An interesting statement is about the efficacy of amoxycillin in the treatment of resistant malaria (page 92). This requires authentication.

An important topic is the 'Quality Assurance in Diagnostic, Therapeutic and Control Measures in Malaria'. The subject could have been developed better and the reader would probably have appreciated if the paper provided solutions rather than reiterate the impediments to malaria control. Similarly, the chapter on Geographic Information System raised expectations that were not fulfilled. The presentations could have illustrated the use of the information to predict or control outbreaks of malaria.

The chapter on house dust mite allergy makes interesting reading and describes a truly environmental issue. The chapter on

sexuality in *Trypanosoma* infuses a flavour of basic science and deals with the arthropod phase of vector-borne protozoal infection. The chapter on Leishmaniasis is quite comprehensive and packs a fair amount of information on the infection. Unfortunately the section on therapeutics is not up to date. The chapter on the interplay of the environment and viral infections is a good one. Though some of the statements could be contested, the presentation makes good reading.

The second section takes the reader through the management of diarrhoeal infections rightly accenting on oral rehydration. The spread of multidrug resistance amongst *Shigellae* has overtaken the drug recommendation in the chapter. The recommendations do not reflect the present state.

The science behind the development of a DNA-based diagnostic method for *Giardia* infection is a bit of basic science in this book. The elegant diagnostic test would unfortunately have limited utility as the infection is characteristically prevalent in the poorer sections of the population. The chapter on Hepatitis (A&E) highlights the role of the viruses in causing water-borne infection. The chapter also deals with the dilemma of developing countries as regards HAV vaccination. Immunity after HEV infection is short-lived in comparison to the solid immunity after childhood HAV infection.

Rhinosporidiosis has for long been an enigmatic infection. The characteristic histology made this a favourite spot slide for medical examinations. The uncultivable organism has intrigued microbiologists. The chapter on infection in this volume presents evidence to align it with cyanobacteria, particularly *Microcystis aeruginosa* – a prokaryote. However, later work seems to indicate the affinity of *Rhinosporidium* with a 'Novel group of aquatic protistan parasites'<sup>1</sup>. In any case the exotic pathogen has moved out of fungi and would find its rightful taxonomic slot.

The last chapter on 'Socio-economic aspect of vector-borne and water-borne diseases' links the subject of the book to the economic status of the country. This is a valid observation when one considers that the decline in infectious diseases in the now developed countries took place in parallel with the rise in their economic status before antibiotics and chemotherapeutic agents were available. It is high time India too spends more on health and poverty alleviation.

Overall, the book is good value for its price. It could have done with better editing. Typographic errors abound. Syntax could be better at places. Despite all the drawbacks, I enjoyed reading the book.

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**Variational Methods in Shape Optimization Problems – Progress in Nonlinear Differential Equations and their Applications**, vol. 65. Dorin Bucur and Giuseppe Buttazzo (eds). Birkhauser, Boston, C/o Springer Science, Business Media Inc, 233, Spring Street, New York, NY 10013, USA. 210 pp. Price: 62.06 Euro.

This book is a collection of lecture notes from the two courses given in the academic year 2000–2001 by the authors at the Dipartimento di Matematica Universit di Pisa and at Scuola Normale Superiore di Pisa. These courses were mainly addressed to Ph D students and required background topics in functional analysis and functional spaces. It presents both classical and modern aspects of the fascinating field of shape optimization very well. The intriguing feature is ‘shape’, i.e. domains of  $R^N$  space, instead of functions as is the case in calculus of variations. A sound mathematical background; specifically variational calculus, functional analysis and spaces, differential equations will be required to understand some of the terminology and concepts. It gives good overview of various mathematical theorems and also discusses classical problems like Newton’s problem

of a least resistance to body moving in fluid, problems in convex domains, etc.

Initially the book introduces the subject with good examples and arouses the interest of the reader. Chapter 1 introduces shape optimization problem in a general way and presents some classical problems like isoperimetric problem and its variants. It gives relevant examples of shape optimization problems like isoperimetric problem, Newton problem of optimal aerodynamical profiles, etc. A shape optimization problem is a minimization problem where the unknown variable runs over a class of domains. Chapter 2 considers an important case where the additional constraint of convexity is assumed on the competing domains. This geometrical constraint is rather strong and sufficient in many cases and provides the extra compactness necessary to guarantee the existence of an optimal solution. An admissible shape plays the role of admissible control in many shape optimization problems. This point along with the relaxation theory is explained in chapter 3 under optimal control problems. Many problems in applied sciences can be modelled by means of optimal control problems. In chapter 4 variational problems with Dirichlet region as one of the unknowns are studied. Continuity under geometrical constraints and under topological constraints is also discussed. Chapter 5 presents existence of classically admissible domains and solutions. Some relevant examples of problems that fulfil the required assumption are also shown. Chapter 6 deals with special case problems where cost functional is dependent on eigenvalues. It discusses stability of eigenvalues under geometric domain perturbation, setting up optimization problem, unbounded design regions, etc. Finally, chapter 7 is devoted to shape optimization problems governed by elliptic equations with Neumann conditions on free boundary. Only homogeneous boundary conditions are considered as this situation is encountered in different physical models (cracks, free parts of structure, image segmentation, etc.).

Different schemes of problems are presented with definitions, illustrations, good examples and proofs wherever required. Several problems that are still open are also discussed. Problems to which optimization can be applied like boundary value problems, problems governed by partial differential equations (PDE), etc. are also analysed. Certain advanced topics that are generally not pre-

sent in the books for graduate students are discussed; like optimal control problems, optimization problems for functions of eigenvalues, problems governed by PDE, problems of free boundary Neumann conditions, etc. Various shape optimization problems, associated theories, relaxation solutions, particular contrary cases, etc. are also explained, along with additional difficulties that may arise. General nature problems, existence of solution, stability of solution have also been discussed. Many shape optimization books consider the topic from the engineering perspective with emphasis on numerical algorithms and solution techniques, but this book gives good mathematical background substantiated by examples; which includes problems of optimum shaped cantilever, quasistatic growth of brittle fracture, variable boundary problems, etc. Theoretical aspects of these are dealt in quite a nice manner. Although it covers many advanced problems of engineering interest and gives introduction to practical problems, the practical problems are dealt and discussed in short.

This book also gives a good bibliography covering about 200 references of this rapidly developing subject. It can serve as an all-time reference for those who are keen on mathematical framework for practical problems and their solutions. It will be useful to the students for advanced optimization topics. For people with mathematics background, it gives good collection of theorems and lemmas associated with the subject of shape optimization. For engineering people, it provides an in-depth basis for development of mathematical structure that forms foundations of numerical solution techniques.

It is commendable that the author has been able to include so much material in a book of 210 pages, and yet the book is well written, and the material is presented in a readable format. It covers all the important topics required to teach basic concepts and methods of optimization, with special emphasis on mathematical formulation. These topics are presented in a concise yet rigorous manner. This study can serve as an excellent text for a graduate course in variational methods for shape optimization to both students and instructors.

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