
Encyclopedia of Parasitology

Heinz Mehlhorn
Editor

Encyclopedia of Parasitology

Fourth Edition

With 1643 Figures and 487 Tables

 Springer

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Preface to the Fourth Edition

Globalization and global warming are the terms of our times and include a daily constant and extremely rapid transportation of millions of humans and animals, plants, food, and goods over often far distances from one region of the world to any other and back. This has increased the likelihood of a broad and intensive import and export of parasites, their vectors, and/or transmitted agents of diseases, which may give rise to the local endemics arising worldwide or even pandemics of considerable impact for human and animal health and all related economic factors. Thus there are no more tropical diseases that can be avoided by not entering such countries. Today we have traveler's disease, we have local zoonoses, and we have diseases due to imported animals and plants. The latter may have severe consequences in countries where such diseases had been absent up to now since the people, animals, and plants have not had the chance to develop immunity or other means of protection.

Therefore, we are aware that the knowledge in the field of parasitology – especially in transmission, diagnosis, and treatment – must be kept at a high level and up to date in order to fight a parasitosis, from wherever, as quickly and effectively as possible.

The presentation of our fourth edition of the *Encyclopedia of Parasitology* contributes to these goals in several ways. The number of keywords has been considerably increased, their contents include important new knowledge gained since 2008, and perception of the facts has been ameliorated by adding more tables, more figures, and an even closer connection by setting more links from one keyword to another. The quick and effective finding of updated information in human, veterinary, and biological aspects of parasitology is offered by more than 40 contributors, all of whom are well-known specialists in their field of research and who are all active in cooperation with their governments in the daily fight against the diseases deriving from parasitic infections of all kinds.

The fourth edition is presented in three volumes, sorted A–Z, and in an online version, both of which make it easy for all users to obtain the needed information within a minimum of time.

I am very grateful to all coauthors for their intensive, quick reviewing and careful updating of their keywords. I also wish to express my thanks to the readers of the third edition for their broad acceptance of our book, since the complete selling of this edition made it possible to publish the present edition after such a short period.

I hope that our most recent efforts are as well accepted as those of the first three editions and that the readers of our books and the users of our online version have the same benefits as the authors in the fight against parasites and their vectors.

Heinrich-Heine-Universität
Düsseldorf, Germany
November 2016

For the authors
Prof. Dr. H. Mehlhorn (Editor)

Preface to the First Edition

Although in recent decades many methods have been developed to control parasitic diseases of humans and animals, chemoresistance and reduction of budgets for control have caused the problems to increase worldwide. Efforts in the “struggle against parasites” must be redoubled if we are not to become overwhelmed by human health problems and problems of food production. This absolute need has led to the application of various new methods to classical parasitology. Thus the different fields of parasitological research are at present expanding so rapidly that it is impossible for an individual to follow the main problems and to evaluate and recognize recent progress.

The purpose of this book is to give a comprehensive review of the facts and trends in veterinary and human parasitology, through contributions from distinguished specialists in different fields. The authors have focused their contributions on the most important and promising results, in a way which it is hoped will inform students, teachers, and researchers (zoologists, veterinarians, physicians) about those topics, which may be far from their own working fields, but knowledge of which may be necessary to develop new ideas. Thus, all chapters, the length of which will surely change in future editions, are provided with references opening the literary entrance to each field of research.

We hope that the book will be fruitful and lead to the establishment of new ideas, trends, and techniques in the struggle against parasites.

Ruhr-Universität Bochum, FRG
Bochum, January 1988

For the authors
Prof. Dr. H. Mehlhorn (Editor)

Preface to the Third Edition

Globalization is the term of our time, and includes a daily constant and extremely rapid transportation of millions of humans and animals, plants, foods, and goods over often far distances from one region of the world to any other and back.

This, of course, has increased the likelihood of a broad and intensive import and export of parasites, their vectors and/or transmitted agents of diseases, which may give rise to the local endemics arising worldwide or even pandemics of considerable impact for human and animal health and all related economic factors. Thus there are no more tropical diseases, which can be avoided by not entering such countries. Today we have traveler's disease, we have local zoonoses, and we have diseases due to imported animals and plants. The latter may have severe consequences in countries where such diseases had been absent up to now since the people, animals, and plants have not had the chance to develop immunity or other means of protection. An example is the Blue-tongue-virus-disease of ruminants – transmitted by ceratopogonid blood-suckers, which in summer 2006 was apparently imported (inside game animals) from South Africa to Central Europe and has spread within a few months in the Netherlands, Belgium, Northern France, and wide regions of Germany seriously harming the rearing of cattle and sheep.

Therefore, we are aware that the knowledge in the field of parasitology – especially in transmission, diagnosis, and treatment – must be kept at a high level and up to date in order to fight a parasitosis, from wherever, as quickly and effectively as possible.

The presentation of our third edition of the Encyclopedia of Parasitology contributes to these goals in several ways. The number of keywords has been increased by about 30 %, their contents include important new knowledge gained since 2001, and perception of the facts has been ameliorated by adding 20 % more tables, more figures, and an even closer connection by setting more links from one keyword to another. The quick and effective finding of updated information in human, veterinary, and biological aspects of parasitology is offered by more than 40 contributors, all of whom are well-known specialists in their fields of research, and who are all active in cooperation with their governments in the daily fight against the diseases deriving from parasitic infections of all kinds.

The third edition is presented as two volumes, sorted A to Z, and in an online version, both of which make it easy for all users to obtain the needed information within a minimum of time.

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I hope that our most recent efforts are as well accepted as with the first two editions, and that the readers of our book and the users of our online version have the same benefit as the authors, when working on our parasitologic topics.

Heinrich-Heine-Universität
Düsseldorf, Germany
September 2007

For the authors
Prof. Dr. H. Mehlhorn (Editor)

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All other micrographs are either from the authors of the particular chapter or from the editor.

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Authorships of Articles in the Present Text Without Author Addresses

The nonpersonally named authors of keywords of the here included articles of the first three editions are contributed by the following persons:

- Acanthocephala (Taraschewski, Karlsruhe)
- Antibodies (Seitz and Reiter-Owona, Bonn)
- Arboviruses (Aspöck, Vienna and Dobler, Munich)
- Behavior (Taraschewski, Karlsruhe)
- Cell penetration (Dubremetz, Montpellier)
- Chemotherapy against helminthoses (Raether, Frankfurt and Harder, Leverkusen)
- Chemotherapy against protozoan diseases (Raether and Hänel, Frankfurt)
- Classification (Mehlhorn, Düsseldorf)
- Clinical and pathological signs of parasitic infections in domestic animals (Vercruysse, Ghent; de Bont, Ghent and Dauguschies, Leipzig)
- Clinical and pathological signs of parasitic infections in man (Frenkel, Kansas and Mehlhorn, Düsseldorf)
- Connecting entries (Mehlhorn, Düsseldorf)
- Drug action in ectoparasites (Turberg and Londershausen, Leverkusen)
- Drug action in protozoa and helminths (Harder, Leverkusen)
- Drug tables (Raether, Frankfurt)
- Ecological aspects (Combes, Perpignan)
- Ectoparasitizides (Londershausen and Hansen, Leverkusen)
- Environmental aspects (Combes, Perpignan)
- Epidemiological aspects (Wernsdorfer, Vienna)
- Eye parasites (Mehlhorn, Düsseldorf)
- Fine structure of parasites (Mehlhorn, Düsseldorf)
- Hormones (Spindler, Ulm)
- Host finding mechanisms (Haas, Erlangen)
- Host parasite interface (Dubremetz, Montpellier and Mehlhorn, Düsseldorf)
- Immunodiagnostic methods (Seitz and Reiter-Owona, Bonn)
- Immunological responses of the host (Gessner and Röllinghoff, Erlangen)
- Insects as vectors (Schaub, Bochum)
- Life cycles (Mehlhorn and Walldorf, Düsseldorf)
- Lyme disease (Spielman, Boston; Armstrong, Boston and Mehlhorn, Düsseldorf)

- Mathematical models (Freeman, Boston and Lehmacher, Cologne)
- Metabolism (Köhler, Zurich and Tielens, Utrecht)
- Molecular systematics (Mackenstedt, Hohenheim)
- Morphology (Mehlhorn, Düsseldorf)
- Motility (Dubremetz, Montpellier and Mehlhorn, Düsseldorf)
- Nerves-structures and functions (Gustafsson, Abo and Maule, Belfast)
- Novel drugs (Kayser and Julsing, Dortmund)
- Nutrition (Köhler, Zurich and Tielens, Utrecht)
- Opportunistic agents, except *Pneumocystis* (Mehlhorn, Düsseldorf)
- Pathologic effects in animals (Vercruysse, Ghent; de Bont, Ghent and Dauschies, Leipzig)
- Pathologic effects in humans (Frenkel, Kansas and Mehlhorn, Düsseldorf)
- Pathology (Frenkel, Kansas and Mehlhorn, Düsseldorf)
- Pentastomida (Walldorf, Düsseldorf)
- Phylogeny (Mackenstedt, Hohenheim)
- Physiological aspects (Köhler, Zurich and Tielens, Utrecht)
- Planning of control (Wernsdorfer, Vienna)
- *Pneumocystis* (Kaneshiro and Smulian, Cincinnati)
- Reproduction (Mehlhorn, Düsseldorf)
- Resistance against drugs (Harder, Leverkusen)
- Serology (Seitz and Reiter-Owona, Bonn)
- Strategy of control measurements (Wernsdorfer, Vienna)
- Ticks as vectors in animals (Mehlhorn, Düsseldorf)
- Ticks as vectors in humans (Spielman, Boston; Armstrong, Boston and Mehlhorn, Düsseldorf)
- Ultrastructure (Mehlhorn, Düsseldorf)
- Vaccination
 - Protozoa (Behr and Pereira da Silva, Paris)
 - Plathelminthes (Richter, Berlin)
 - Nemathelminthes (Schnieder, Hannover)
- Vector biology
 - Insects (Schaub, Bochum and Mehlhorn, Düsseldorf)
 - Ticks (Spielman and Mehlhorn, Düsseldorf)

About the Editor

Prof. Dr. Heinz Mehlhorn Curriculum Vitae



Private

30.09.1944	Born in Aussig/Elbe, Germany
1964–1971	Studies in Bonn (Biology, Chemistry)
1973	Married with Birgit
	3 children: Martin, Isabelle, Tim
	1 grandson: Henry

Career

1971	PhD Natural Sciences, Bonn University
1975	Habilitation Düsseldorf University
1977	Professor for Parasitology, Düsseldorf
1984	Professor for Parasitology, Bochum
1987–1992	Dean University Bochum
1995–2009	Professor for Parasitology, Düsseldorf University
2000–	Founder and CEO of Research Company Alpha-Biocare, Düsseldorf, Germany

Honors

- Aaronson Price Award, German Government
- Leuckart Medal, German Society of Parasitology

- Member of the Academy of Science
- Honoring Medal of the Japanese Government
- Remembrance Medals King Saud University, Riyadh; Cairo University
- Reviewer Excellence Centers Japan, Australia, Saudi Arabia
- President German Society of Parasitology
- World President Protozoology
- Steering Board of World Society of Parasitology
- Guest professorships: Japan, Egypt, France, Saudi Arabia, China

Scientific Output

- 26 patents on antiparasitic drugs
- 25 books
- 250 original papers
- Since 1987: Chief Editor of *Parasitology Research*
- Yearly television and radio broadcasts on parasitological topics
- Since 1987 more than 150 PhD students: 27 are professors today (in several countries)

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