

THE
TBE
BOOK **SEVENTH EDITION**

Prof. Dr. Gerhard Dobler
Dr. Wilhelm Erber
Dr. Michael Bröker
Dr. Lidia Chitimia-Dobler
Prof. Dr. Heinz-Josef Schmitt

GLOBAL
HEALTH
PRESS

Published by
Global Health Press Pte Ltd
50 Kaki Bukit Place
#04-01 Jean Yip Building
Singapore 415926

<https://tbenews.com/tbe/>

The TBE Book (7th Edition)

Copyright © Global Health Press Pte Ltd, 2024

All rights reserved. Without limiting the rights under copyright reserved above, no part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, scanning, or otherwise), without the prior written permission of both the copyright owners and publisher of this book.

The greatest care has been taken in compiling this book. However, no responsibility can be accepted by the publisher or compilers for the accuracy of the information presented.

Where opinion is expressed it is that of the author and does not necessarily coincide with the editorial views of Global Health Press.

While every effort has been made to contact copyright-holders of material produced or cited in this book, in the case of those it has not been possible to contact successfully, the editors, authors, and the publisher will be glad to make amendments in further editions.

Publication of this book was funded by Pfizer Inc.

ISSN: 2661-3980

Foreword to the 7th Edition of THE TBE BOOK: A Comprehensive Guide to Tick-Borne Encephalitis

Dear Readers!

It is with great pleasure that we present to you the 7th edition of THE TBE BOOK, a comprehensive guide to Tick-Borne Encephalitis (TBE). Over the past two years, this book has reached an astonishing milestone of over 1 million readers worldwide, and our TBE News including newsletter accompanying The TBE BOOK in April 2024 reached more than 20,000 readers in the United States alone – although not a single autochthonous case of TBE has ever been reported from that country. We are immensely encouraged by the overwhelming response and continue our commitment to providing the most up-to-date information on TBE with this latest edition.

Embracing the E-CDC Definition

In this edition, we have fully embraced the European Centre for Disease Prevention and Control (ECDC) definition of “arbovirus disease risk”, where regions are classified as “predisposed” [climate and territory would allow TBE-virus (TBEV) circulation], “imperiled” (TBEV detected, but no case in a human), “affected” (single sporadic autochthonous TBE cases reported), or “endemic” (annual documentation of several human TBE cases). This appears to us to be the currently best scientifically sound approach to document the risk for TBEV-infections, as to date testing for the disease is largely incomplete, even in endemic countries and even for patients with symptoms of encephalitis during the active tick season.

Major Updates and New Chapters

The 7th edition of THE TBE BOOK features significant updates to the main chapters, including:

Historical Perspective: We delve into the roots of TBE, exploring the discovery of the TBEV in the Soviet Union in the early 1900s and the social and political circumstances that precipitated this discovery. Additionally, we provide a general summary of the TBE-associated work of the six main scientists who unraveled the mysteries surrounding TBE in Europe, including the recently “rediscovered” ground-breaking epidemiological work by Dr. Hans Schneider, elucidating TBE infections by types of exposures.

Microbial Species Transmitted by Ticks: We have added a comprehensive chapter on the ever-increasing number of pathogens transmitted by ticks, as they are relevant for differential diagnostic considerations. This chapter will assist physicians in their efforts to make accurate and timely diagnoses based on clinical findings and microbiological confirmation.

TBE in Children: We have included more comprehensive data on TBE in children, with a focus on long-term adverse outcomes. Different from the current general belief, TBE is NOT a mild and neglectable disease in the young but frequently results in long-term cognitive and psychological impairments – even if the initial disease is just a “mild encephalitis”.

Epidemiology and Public Health Aspects

The epidemiology section has been updated to reflect the increase in TBE cases in Northern and Central Europe, as well as the spreading (or just the “recent detection”) of the virus to Africa (Tunisia). We also discuss the concept of “risk areas” – predisposed, imperiled, affected, and endemic – as proposed by the ECDC, and how “incidence data” may be misleading in judging the risk of contracting the disease. Additionally, we explore the potential reasons behind the increase in reported cases, despite increasing vaccine uptake, and whether this is due to increased awareness and testing, increased exposure, or other factors.

Furthermore, we provide detailed information on the public health aspects of TBE, emphasizing that it has been a vaccine-preventable disease for more than 50 years. Recent studies have documented high and long-lasting vaccine effectiveness, leading countries like Switzerland and Finland to recommend a simplified (2+1) vaccination schedule with extended 10-year boosters for the two vaccines licensed in Europe. Information on the Russian and Chinese TBE vaccines has also been updated.

Underdiagnosis and the Way Forward

Despite the availability of vaccines, TBE – even severe cases – remains hugely underdiagnosed in Europe and Asia, and we are far from systematic testing for this disease. This 7th edition of THE TBE BOOK aims at raising awareness and providing valuable insights to combat these challenges by further research.

We hope that this comprehensive guide will prove valuable to healthcare professionals, public health officers, travel medicine colleagues, researchers, travelers and anyone interested in understanding, diagnosing and preventing TBE. Join us on this journey as we continue to unravel the mysteries surrounding this important disease.

We thank all authors for their valuable time, work and dedication; we thank all members of the publishing team with Global Health Press in Singapore for their hard and focused work; the language Editor for finding and correcting all the big and small errors in each manuscript and finally we thank the publisher for her commitment to this work.

Munich, Nierstein, Marburg (Germany), Vienna (Austria), Singapore

June, 2024

The Editors

List of Contents

Introduction	3
Gerhard Dobler, Wilhelm Erber, Michael Bröker, Lidia Chitimia-Dobler, Heinz-Josef Schmitt - Editors	
Chapter 1: Tick-borne human diseases around the globe	14
Tatjana Vilibić-Čavlek, Maja Bogdanić, Vladimir Savić, Ljubo Barbić, Vladimir Stevanović, Bernard Kaić	
Chapter 2: Tick-borne-flavivirus serocomplex: phylography and bio-geography	23
Daniel Lang, Teemu Smura, Gerhard Dobler, Olli Vapalahti	
Chapter 3a: Early TBE research in the Soviet Union: revisiting the narrative	24
Anna Mazanik	
Chapter 3b: Short history of TBE research and the scientists behind it	34
Mirko Lange, Lidia Chitimia-Dobler, Gerhard Dobler	
Chapter 4: TBE virology	44
Daniel Růžek, Kentaro Yoshii, Marshall E. Bloom, †Ernest A. Gould	
Chapter 5: TBEV-transmission and natural cycles	63
Lidia Chitimia-Dobler	
Chapter 6: Pathogenesis of TBEV-diseases	82
Anna K Överby, Saravanan Thangamani	
Chapter 7: Immunology of TBEV infection	98
Kyra D. Zens, Rahel Ackermann-Gäumann	
Chapter 8: TBE in children	110
Malin Veje, Zane Freimane, Dace Zavadska	
Chapter 9: TBE in adults	116
Johann Sellner, Petra Bogovic, Joanna Zajkowska	
Chapter 10: TBE in animals	133
Martin Pfeffer, Michael Leschnik	
Chapter 11: Diagnostic of TBEV-infections	148
Gerhard Dobler	
Chapter 12: TBE-epidemiology by country – an overview	156
Wilhelm Erber, Michael Broecker, Gerhard Dobler, Lidia Chitimia-Dobler, Heinz-Josef Schmitt	

Chapter 13: TBE by country – country data

• Austria: Karin Stiasny, Simon Raffl, Stephan W. Aberle, Judith H. Aberle	175
• Belarus: Oksana Hanenko, Natalia Kolomiets, Alla Dashkevich, Vlada Zapolskaya, Igor Stoma	180
• Belgium: Marjan Van Esbroeck, Tinne Lernout, Steven Van Gucht	184
• Bosnia and Herzegovina: Wilhelm Erber, Tamara Vuković-Janković	187
• Bulgaria: Iva Christova	189
• China: Yang Junfeng, Heinz-Josef Schmitt	192
• Croatia: Tatjana Vilibić-Čavlek, Maja Bogdanić, Vladimir Savić, Ljubo Barbić, Vladimir Stevanović, Bernard Kaić	197
• Czech Republic: Petr Pazdiora	202
• Denmark: Anders Fomsgaard	207
• Estonia: Kuulo Kutsar	211
• Finland: Anu Jääskeläinen, Heidi Åhman	216
• France: Yves Hansmann, Aurélie Velay	221
• Germany: Gerhard Dobler	227
• Hungary: Anna Nagy, Ferenc Schneider, Eszter Mezei, András Lakos	232
• Italy: Valentina Tagliapietra, Martina Del Manso, Flavia Riccardo, Anna Teresa Palamara	238
• Japan: Kentaro Yoshii	244
• Kazakhstan: Andrey Dmitrovskiy	249
• Kyrgyzstan: Wilhelm Erber	255
• Latvia: Dace Zavadska, Zane Freimane	256
• Lithuania: Auksė Mickienė	264
• Moldova: Olga Sofronie, Olga Burduniuc, Greta Bălan	270
• Mongolia: TserenNorov Damdindorj, Uyanga Baasandagva, Uranshagai Narankhuu, Tsogbadrakh Nyamdorj, Burmaajav Badrakh, Burmaa Khoroljav	272
• Netherlands: Johannes H. J. Reimerink, Hein Sprong, Margriet Harms, Chantal B.E.M. Reusken	278
• Norway: Rose Vikse, Urusha Maharjan, Arnulf Soleng, Heidi E.H. Lindstedt, Rikard Rykkvin, Kristian Alfsnes, Åshild K. Andreassen	283
• Poland: Katarzyna Pancer	292
• Romania: Lidia Chitimia-Dobler, Adriana Hristea, Wilhelm Erber, Tamara Vuković-Janković	299
• Russia: Sergey Tkachev, Maria Esyunina, Maria Syrochkina	303
• Serbia: Pavle Banović	316
• Slovakia: Jana Kerlik	320
• Slovenia: Zoran Simonović, Veronika Učakar, Maja Praprotnik	328
• South Korea: Song Joon Young	334
• Sweden: Åke Lundkvist	338
• Switzerland and Liechtenstein: Kyra Zens	345
• Tunisia: Elyes Zhioua	354
• Ukraine: Iryna Kolesnikova, Khrysthyna Hrynkevych	355
• United Kingdom: Maya Holding, Gillian Ellsbury	358

Chapter 14: Public health aspects of TBE

Phunc Lang, Rahel Ackermann

363

Chapter 15: TBE vaccines licensed around the globe

Herwig Kollaritsch, Eva Maria Pöllabauer

383

List of contributing authors

(in alphabetical order)

Prof. Dr. Judith H. Aberle,

Center for Virology, Medical University of Vienna, 1090 Vienna, Austria

Prof. Dr. Stephan W. Aberle,

Center for Virology, Medical University of Vienna, 1090 Vienna, Austria

Dr. Rahel Ackermann-Gäumann,

Microbiologie, ADMED Analyses et Diagnostics Médicaux, La Chaux-de-Fonds, Switzerland.

Swiss National Reference Center for Tick-transmitted Diseases, La Chaux-de-Fonds, Switzerland.

Dr. Heidi Åhman,

Senior Manager Medical Lead Finland & Baltics, Pfizer Vaccines, Helsinki, Finland

Dr. Kristian Alfsnes,

Norwegian Institute of Public Health

Prof. Dr. Åshild Andreassen,

Norwegian Institute of Public Health, Division for Infection Control and Environmental Health, Oslo, Norway

Dr. Uyanga Baasandagva,

Epidemiologist, National Center for Zoonotic Diseases, Ulaanbaatar, Mongolia

Prof. Dr. Burmaajav Badrakh,

Scientific Secretary of the Mongolian Academy of Medical Sciences and Head of Public Health Department of "Ach" Medical University, Ulaanbaatar, Mongolia

Prof. Dr. Greta Bălan,

MD, PhD, Associate Professor, Nicolae Testemițanu State University of Medicine and Pharmacy of the Republic of Moldova, Microbiology and Immunology Discipline

Dr. Pavle Banović,

Assist. Dr. sci. med. Pavle Banović, Department of Microbiology with Parasitology and Immunology, Faculty of Medicine in Novi Sad, University of Novi Sad, 21000 Novi Sad, Serbia

Diagnostics and Laboratory Research Task Force, Balkan Association for Vector-Borne Diseases, 21000 Novi Sad, Serbia and Pasteur Institute Novi Sad, 21000 Novi Sad, Serbia

Prof. Dr. Ljubo Barbić,

Department of Microbiology and Infectious Diseases with Clinic, Faculty of Veterinary Medicine University of Zagreb, 10000 Zagreb, Croatia

Dr. Marshall E. Bloom,

National Institutes of Health, Laboratory of Virology, Rocky Mountain Laboratories, Hamilton, MT, USA

Dr. Maja Bogdanić,

National Reference Laboratory for Arboviruses, Reference Center for Diagnosis and Surveillance of Viral Zoonoses of the Croatian Ministry of Health, Department of Virology, Croatian Institute of Public Health, 10000 Zagreb, Croatia

Dr. Petra Bogovic,

Department of Infectious Diseases, University Medical Centre Ljubljana, Ljubljana, Slovenia

Dr. Michael Bröker,

Editor, Global Health Press, Singapore / Marburg, Germany

Dr. Olga Burduniuc,

MD, PhD, Head of Department of the Laboratory Diagnosis in Public Health, National Agency for Public Health

Dr. Lidia Chitimia-Dobler,

Bundeswehr Institute of Microbiology, Munich, Germany

Prof. Dr. Iva Christova,

Department of Microbiology, National Center of Infectious and Parasitic Diseases, Sofia, Bulgaria

Dr. Tserennorov Damdindorj,

Scientific secretary in National Center for Zoonotic Diseases, Ulaanbaatar, Mongolia

Dr. Alla Dashkevich,

State Institution «Republican Center for Hygiene, Epidemiology and Public Health», Minsk, Belarus

Dr. Martina Del Manso,

Department of Infectious Diseases, Istituto Superiore di Sanità, Roma, Italy

Prof. Andrey Dmitrovskiy,

National Center of Biotechnology, Almaty branch and Kazakh-Russian Medical University, Almaty, Kazakhstan

Prof. Dr. Gerhard Dobler,

Bundeswehr Institute of Microbiology, Munich, Germany

Dr. Gillian Ellsbury,

Medical Director, Vaccines UK & Ireland, Pfizer Vaccines, Tadworth, United Kingdom

Dr. Wilhelm Erber,

Director Medical and Scientific Affairs, Pfizer Vaccines, Vienna, Austria

Dr. Marjan Van Esbroeck,

Department of Clinical Sciences, Institute of Tropical Medicine, Antwerp

Dr. Maria Sergeevna Esyunina,

Medical Advisor, Vaccines, Pfizer, Russia

Dr. Anders Fomsgaard,

Virus R&D Laboratory, Statens Serum Institute, Copenhagen, Denmark
Infectious Disease Research Unit, Clinical Institute, University of Southern Denmark

Dr. Zane Freimane,

Riga Stradins University, Riga, Latvia

Dr. Ernest A. Gould,

Aix-Marseille Université, Marseille, France

Dr. Steven Van Gucht,

Belgian Institute for Health Sciensano, Brussels

Heidi H. Lindstedt,

Senior Adviser, Norwegian Institute of Public Health, Division of Infection Control and Environmental Health, Oslo, Norway

Prof. Dr. Oksana Hanenko,

Institute of Advanced Training and Retraining of Healthcare Personnel of the Belarusian State Medical University, Minsk, Belarus

Dr. Yves Hansmann,

Infectious Disease Department, Strasbourg University Hospital, Strasbourg, France

M.Sc. Margriet Harms,

National Institute for Public Health and the Environment, Bilthoven, the Netherlands

Dr. Maya Holding,

Virology and Pathogenesis Group, National Infection Service, Public Health England, Porton Down, United Kingdom
NIHR Health Protection Research Unit in Emerging and Zoonotic Infections, Liverpool, United Kingdom

Ass. Prof. Adriana Hristea,

National Institute for Infectious Diseases "Prof. Dr. Matei Bals", Bucharest, Romania

Dr. Khrystyna Hrynkevych,

University Hospital Essen

Dr. Anu Jääskeläinen,

Department of Virology, Medicum, University of Helsinki, Helsinki, Finland

Helsinki University Hospital, Laboratory Services (HUSLAB), Department of Clinical Microbiology, Helsinki, Finland

Asst. Prof. Bernard Kaić,

Reference Center for Epidemiology of the Croatian Ministry of Health, Department of Communicable Disease Epidemiology, Croatian Institute of Public Health, 10000 Zagreb, Croatia

Dr. Jana Kerlik,

Department of Epidemiology, Regional Public Health Authority in Banská Bystrica, Slovakia

Dr. Burmaa Khoroljav,

Department of Epidemiology, National Center for Zoonotic Disease, Ulaanbaatar, Mongolia

Prof. Iryna Kolesnikova,

Professor of Epidemiology, Bogomolets National Medical University

Prof. Dr. Herwig Kollaritsch,

Institute for Specific Prophylaxis and Tropical Medicine, Medical University Vienna, Austria

Dr. Natalia Kolomiets,

Institute of Advanced Training and Retraining of Healthcare Personnel of the Belarusian State Medical University, Minsk, Belarus

Dr. Kuulo Kutsar,

Health Board, Tallinn, Estonia

Dr. András Lakos,

Centre for Tick-borne Diseases, Outpatient Service, Budapest, Hungary

Dr. Phung Lang,

Epidemiology, Biostatistics and Prevention Institute (formally Institute of Social and Preventive Medicine), University Zurich

Dr. Mirko Lange,

Institut für Mikrobiologie der Bundeswehr

Dr. Tinne Lernout,

Epidemiology of Infectious Diseases, Epidemiology and Public Health Directorate, Sciensano, Brussels, Belgium

Priv.-Doz.Dr Michael Leschnik,

Clinical Unit of Internal Medicine Small Animals, Department and Clinic of Companion Animals and Horses, University of Veterinary Medicine Vienna, Austria

Prof. Dr. Åke Lundkvist,

Department of Medical Biochemistry and Microbiology, Uppsala University, Sweden

Urusha Maharjan

Medical Laboratory Technologist Norwegian Institute of Public Health

Dr. Anna Mazanik,

Max Weber Network Eastern Europe, Max Weber Foundation, Bonn, Germany

MScPH Eszter Mezei,

Department of Epidemiological and Vaccination Surveillance, National Center for Public Health and Pharmacy, Budapest, Hungary

Prof. Dr. Auksė Mickienė,

Department of Infectious Diseases, Medical Academy of the Lithuanian University of Health Sciences, Kaunas, Lithuania

Dr. Anna Nagy,

National Reference Laboratory for Viral Zoonoses, National Center for Public Health and Pharmacy, Budapest, Hungary

Dr. Uranshagai Narankhuu,

Department of Epidemiology, National Center for Zoonotic Disease, Ulaanbaatar, Mongolia

Dr. Tsogbadrakh Nyamdorj,

Director, National Center for Zoonotic Diseases, Ulaanbaatar, Mongolia

Assoc. Prof. Dr. Anna K. Överby,

Department of Clinical Microbiology, Virology, Umeå University, Sweden
The Laboratory for Molecular Infection Medicine Sweden (MIMS), Umeå, Sweden

Prof. Dr. Anna Teresa Palamara,

Istituto Superiore di Sanità, 00161 Rome, Italy

Dr. Katarzyna Pancer,

Department of Virology, National Institute of Public Health-NIH (NIPH-NIH), Warsaw, Poland

Prof. Dr. Petr Pazdiora,

Faculty of Medicine in Pilsen, Charles University, Pilsen, Czech Republic

Dr. Eva Maria Pöllabauer,

Institute of Specific Prophylaxis and Tropical Medicine, Medical University Vienna, Austria

Maja Praprotnik,

Nacional Institute of Public Health, Slovenija

Prof. Dr. Martin Pfeffer,

Institute of Animal Hygiene and Veterinary Public Health, Center for Veterinary Public Health, Faculty of Veterinary Medicine, University of Leipzig, Germany

Simon Raffl,

Center for Virology, Medical University of Vienna, 1090 Vienna, Austria

Bsc. Johannes Hermanus Jozef Reimerink,

National Institute for Public Health and the Environment (RIVM), Bilthoven, the Netherlands

Dr. Chantal B.E.M. Reusken,

National Institute for Public Health and the Environment (RIVM), Bilthoven, the Netherlands

Dr. Flavia Riccardo,

Department of Infectious Diseases, Istituto Superiore di Sanità, Roma, Italy

Prof. Dr. Daniel Růžek,

Institute of Parasitology, Biology Centre of the Czech Academy of Sciences, České Budějovice, Czech Republic
Faculty of Science, Masaryk University, Brno, Czech Republic
Veterinary Research Institute, Brno, Czech Republic

Rikard Rykkvin,

Norwegian Institute of Public Health Senior Medical Officer

Prof. Dr. Vladimir Savić,

Poultry Center, Croatian Veterinary Institute, 10000 Zagreb, Croatia

Prof. Dr. Heinz-Josef Schmitt,

Editor-in-Chief, Global Health Press, Singapore
Strategic and Scientific Advisor, "Vaccelerate" European Clinical Trial Consortium, Cologne University, Germany

Dr. Hannah M. Schmuck,

Institute of Animal Hygiene and Veterinary Public Health, Center for Veterinary Public Health, Faculty of Veterinary Medicine,

University of Leipzig, Germany

Dr. Ferenc Schneider,

Department of Infectious Diseases, Markusovszky University Teaching Hospital, Szombathely, Hungary

Prof. Dr. Johann Sellner,

Department of Neurology, Landeskrankenhaus Mistelbach-Gänserndorf, Affiliated Department of Karl Landsteiner University of Health Sciences, Mistelbach, Austria

Prof. Dr. Zhanna Shapiyeva,

Science practical Center for sanitary and epidemiological monitoring and expertise, Almaty Kazakhstan

Dr. Zoran Simonović,

National Institute of Public Health, Maribor, Slovenia

Dr. Olga Sofronie,

MD, Microbiologist, Assistant Professor, Nicolae Testemitanu State University of Medicine and Pharmacy of the Republic of Moldova, Microbiology and Immunology Discipline

Dr. Arnulf Soleng,

Norwegian Institute of Public Health, Division for Infection Control and Environmental Health, Oslo, Norway

Prof. Song Joon Young,

Korea University College of Medicine, Seoul, South Korea

Dr. Hein Sprong,

National Institute for Public Health and the Environment, Bilthoven, the Netherlands

Prof. Dr. Vladimir Stevanović

Department of Microbiology and Infectious Diseases with Clinic, Faculty of Veterinary Medicine University of Zagreb, 10000 Zagreb, Croatia

Prof. Dr. Karin Stiasny,

Center for Virology, Medical University of Vienna, Austria

Prof. Dr. Igor Stoma,

Gomel state medical university, Gomel, Belarus

Dr. Maria Syrochkina,

Senior Medical Director Vaccines IDM, Pfizer

Dr. Valentina Tagliapietra,

Research and Innovation Centre, Fondazione Edmund Mach, San Michele all'Adige, Italy

Dr. Saravanan Thangamani,

SUNY Empire Innovation Professor in the Department of Microbiology and Immunology at the SUNY Upstate Medical University.

Assoc. Prof. Dr. Sergey E. Tkachev,

Senior Scientist Researcher of Institute of Fundamental Medicine and Biology, Kazan Federal University, Kazan, Russia

Dr. Veronika Učakar,

Nacional Institute of Public Health, Slovenija

Dr. Malin Veje,

Department of Infectious Diseases, University of Gothenburg, Sweden

Dr. Aurélie Velay,

Institute of Virology, Strasbourg University Hospital, Strasbourg, France

Dr. Rose Vikse,

Norwegian Institute of Public Health, Division for Infection Control and Environmental Health, Oslo, Norway

Prof. Dr. Tatjana Vilibić-Čavlek,

National Reference Laboratory for Arboviruses, Reference Center for Diagnosis and Surveillance of Viral Zoonoses of the Croatian Ministry of Health, Department of Virology, Croatian Institute of Public Health, 10000 Zagreb, Croatia

Dr. Tamara Vuković-Janković,

Senior Medical Manager, Medical and Scientific Affairs, International Developed Markets Pfizer, Belgrade, Serbia

Dr. Yang Junfeng,

Medical Affairs, Pfizer Investment Co., Ltd., Beijing, China

Dr. Kentaro Yoshii,

Laboratory of Public Health, Graduate School of Veterinary Medicine, Hokkaido University, Sapporo, Japan

Prof. Dr. Joanna Zajkowska,

Department of Infectious Diseases and Neuroinfections, Medical University in Białystok, Poland

Dr. Vlada Zapolskaya,

State Institution «Republican Center for Hygiene, Epidemiology and Public Health», Minsk, Belarus

Prof. Dace Zavadska,

Department of Paediatrics, Riga Stradins University, Riga, Latvia. Department of Children Infectious Diseases, Children Clinical University Hospital, Riga, Latvia

Dr. Kyra D. Zens,

Department of Viral Immunobiology, Institute for Experimental Immunology, University of Zurich, Zurich Switzerland. Department of Public and Global Health, Epidemiology, Biostatistics and Prevention Institute, University of Zurich, Zurich Switzerland

Prof. Elyes Zhioua,

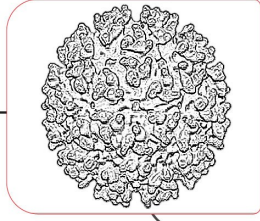
Department of Parasitology, Institute Pasteur of Tunisia, Tunis, Tunisia

TBE milestones

20th Century



100 million years old: tick¹



10,000 years old: TBE virus²



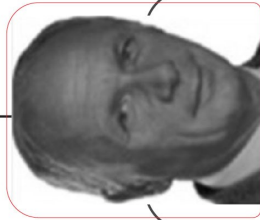
1931
Hans Schneider
First description of the clinical aspects of TBE³



1937
Lev Alexandrovich Zil'ber
First scientist in the Western World to isolate the TBEV⁴



1938
Evgeny Pavlovsky
First scientist to document the way of transmission of the TBEV⁵



1976
Christian Kunze
Pioneer of the first modern cell-culture based TBE vaccine⁶

Note:

1. Tick in Burmese amber, about 100 million years old. Credit: Dr. Lidia Chitimia-Dobler, Bundeswehr Institute of Microbiology, Munich, Germany
2. TBEV under an electron microscope. Credit: PD Dr. Sandra Essbauer, Bundeswehr Institute of Microbiology, Munich, Germany
3. Cover of the book *The epidemic acute "meningitis serosa"*, written by Hans Schneider and published by Maudric Verlag, Vienna, 1932
4. Lev Zilber. Photo from the book *Lev Alexandrovich Zilber* written by his sons L.L. Kisselev and E.S. Levina, published in 2005 by the publishing house *Science* in the series "Scientific biographies"
5. Evgeny Pavlovsky. Credit: Laboratory of Parasitology, Zoological Institute RAS
6. Christian Kunz. Credit: Priv.-Doz. Dr. Gerhard Dobler, Bundeswehr Institute of Microbiology, Munich, Germany

List of abbreviations

ADE	Antibody mediated disease enhancement
AE	Adverse Event
CMV	Cytomegalovirus
CNS	Central Nervous System
CSF	Cerebrospinal Fluid
CT	Computerized Tomography
DENV	Dengue virus
ECDC	European Center for Disease Prevention and Control
EEG	Electro-Encephalography
EMA	European Medicines Agency
FDA	(usually: The American) Food and Drug Administration
GMT	Geometric Mean Titer
HI	Hemagglutinin Inhibition
IFA	Immuno Fluorescence Assay
JEV	Japanese Encephalitis Virus
KFD	Kyasanur Forest Disease
NIP	National Immunization Program
NT	Neutralization Test
OHFV	Omsk Haemorrhagic Fever Virus
POWV	Powassan Virus
TBEV	Tick-Borne Encephalitis Virus
TBEV-EU	Tick-Borne Encephalitis Virus, European subtype
TBEV-FE	Tick-Borne Encephalitis Virus, Far-Eastern subtype
TBEV-SIB	Tick-Borne Encephalitis Virus, Siberian subtype
TBEV-HIM	Tick-Borne Encephalitis Virus, Himalaya subtype
TBEV-BKL	Tick-Borne Encephalitis Virus, Baikalian subtype
WHO	World Health Organization
WNV	West Nile Virus
YFV	Yellow Fever Virus