

Laboratory Models for Foodborne Infections



FOOD MICROBIOLOGY SERIES

Series Editor
Dongyou Liu

Laboratory Models for Foodborne Infections, *edited by Dongyou Liu* (2017)

Food Spoilage Microorganisms: Ecology and Control, *edited by Yanbo Wang* (2017)

Foodborne Viral Pathogens, *edited by Peter A. White, Natalie E. Netzler, and Grant S. Hansman* (2016)

Molecular Biology of Food and Water Borne Mycotoxigenic and Mycotic Fungi,
edited by R. Russell M. Paterson, and Nelson Lima (2015)

Biology of Foodborne Parasites, *edited by Lihua Xiao, Una Ryan, and Yaoyu Feng* (2015)

Laboratory Models for Foodborne Infections

Edited by

Dongyou Liu

Royal College of Pathologists of Australasia Quality Assurance Programs
New South Wales, Australia



CRC Press

Taylor & Francis Group

Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an **informa** business

CRC Press
Taylor & Francis Group
6000 Broken Sound Parkway NW, Suite 300
Boca Raton, FL 33487-2742

© 2017 by Taylor & Francis Group, LLC
CRC Press is an imprint of Taylor & Francis Group, an Informa business

No claim to original U.S. Government works

Printed on acid-free paper

International Standard Book Number-13: 978-1-4987-2167-7 (Hardback)

This book contains information obtained from authentic and highly regarded sources. Reasonable efforts have been made to publish reliable data and information, but the author and publisher cannot assume responsibility for the validity of all materials or the consequences of their use. The authors and publishers have attempted to trace the copyright holders of all material reproduced in this publication and apologize to copyright holders if permission to publish in this form has not been obtained. If any copyright material has not been acknowledged, please write and let us know so we may rectify in any future reprint.

Except as permitted under U.S. Copyright Law, no part of this book may be reprinted, reproduced, transmitted, or utilized in any form by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying, microfilming, and recording, or in any information storage or retrieval system, without written permission from the publishers.

For permission to photocopy or use material electronically from this work, please access www.copyright.com (<http://www.copyright.com/>) or contact the Copyright Clearance Center, Inc. (CCC), 222 Rosewood Drive, Danvers, MA 01923, 978-750-8400. CCC is a not-for-profit organization that provides licenses and registration for a variety of users. For organizations that have been granted a photocopy license by the CCC, a separate system of payment has been arranged.

Trademark Notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Library of Congress Cataloging-in-Publication Data

Names: Names: Liu, Dongyou, editor.
Title: Laboratory models for foodborne infections / [edited by] Dongyou Liu.
Other titles: Food microbiology series.
Description: Boca Raton : CRC Press/Taylor & Francis, 2017. | Series: Food microbiology series | Includes bibliographical references and index.
Identifiers: LCCN 2016040619 | ISBN 9781498721677 (hardback : alk. paper)
Subjects: | MESH: Foodborne Diseases | Models, Animal | Models, Biological | Food Microbiology
Classification: LCC QR201.F62 | NLM WC 268 | DDC 615.9/5293--dc23
LC record available at <https://lccn.loc.gov/2016040619>

Visit the Taylor & Francis Web site at
<http://www.taylorandfrancis.com>

and the CRC Press Web site at
<http://www.crcpress.com>

Contents

Preface for Food Microbiology Series.....	ix
Preface	xi
Editor	xiii
Contributors	xv

1. Introductory Remarks.....	1
<i>Dongyou Liu</i>	

Section I Foodborne Infections due to Viruses

2. Adenoviruses.....	13
<i>Anthony P. Malanoski and Baochuan Lin</i>	
3. Astrovirus.....	29
<i>Matthew D. Koci and Stacey L. Schultz-Cherry</i>	
4. Hepatitis E Virus.....	41
<i>Kavita Lole, Prudhvi Lal Bhukya, and Subhashis Chatterjee</i>	
5. Noroviruses: Laboratory Surrogates for Determining Survival and Inactivation	75
<i>Doris H. D'Souza and Snehal S. Joshi</i>	
6. Rotavirus.....	95
<i>Lijuan Yuan and Ke Wen</i>	
7. Prions.....	117
<i>Akikazu Sakudo and Takashi Onodera</i>	

Section II Foodborne Infections due to Gram-Positive Bacteria

8. Bacillus.....	131
<i>Jessica Minnaard, Ivanna S. Rolny, and Pablo F. Pérez</i>	
9. Clostridium.....	155
<i>Emilio Aranda, María G. Córdoba, María J. Benito, and Juan José Córdoba</i>	
10. Enterococcus	175
<i>Dongyou Liu</i>	
11. Listeria monocytogenes	185
<i>Sarah E.F. D'Orazio</i>	

12. <i>Mycobacterium</i>	197
<i>Flábio R. de Araújo and Nalvo F. Almeida</i>	
13. <i>Staphylococcus</i>	209
<i>Mar Rodríguez, Alicia Rodríguez, María Jesús Andrade, Elena Bermúdez, and Juan José Córdoba</i>	
14. <i>Streptococcus</i>	223
<i>Dongyou Liu</i>	

Section III Foodborne Infections due to Gram-Negative Bacteria

15. <i>Aeromonas</i>	237
<i>Dongyou Liu</i>	
16. <i>Bacteroides</i>	247
<i>Mario Julio Avila-Campos</i>	
17. <i>Brucella</i>	259
<i>S.C. Olsen and B. Bricker</i>	
18. <i>Burkholderia</i>	271
<i>Danielle L. Peters, Fatima Kamal, and Jonathan J. Dennis</i>	
19. <i>Campylobacter</i>	289
<i>Martin Stahl and Bruce A. Vallance</i>	
20. <i>Cronobacter: Virulence and Pathogenesis</i>	305
<i>Nemani V. Prasadarao</i>	
21. <i>Escherichia</i>	317
<i>Dongyou Liu</i>	
22. <i>Helicobacter</i>	331
<i>Tetsuya Tsukamoto, Yuka Kiriya, and Masae Tatematsu</i>	
23. <i>Klebsiella: Caenorhabditis elegans as a Laboratory Model for Klebsiella pneumoniae Infection</i>	343
<i>Arumugam Kamaladevi and Krishnaswamy Balamurugan</i>	
24. <i>Proteus</i>	355
<i>Paola Scavone, Victoria Iribarnegaray, and Pablo Zunino</i>	
25. <i>Pseudomonas aeruginosa</i>	373
<i>Stavria Panayidou and Yiorgos Apidianakis</i>	
26. <i>Salmonella</i>	391
<i>Dongyou Liu</i>	
27. <i>Shigella</i>	401
<i>Soumik Barman and Yoshifumi Takeda</i>	

28. <i>Vibrio: Caenorhabditis elegans</i> as a Laboratory Model for <i>Vibrio</i> Infections	413
<i>Sellegounder Durai and Krishnaswamy Balamurugan</i>	

29. <i>Yersinia</i>	427
<i>Xin Wang, Ran Duan, Junrong Liang, Wenpeng Gu, and Huaiqi Jing</i>	

Section IV Foodborne Infections due to Fungi

30. <i>Alternaria</i>	441
<i>Alicia Rodríguez, Andrea Patriarca, Mar Rodríguez, María Jesús Andrade, and Juan José Córdoba</i>	

31. <i>Aspergillus</i>	455
<i>László Kredics, János Varga, Rajagopalaboopathi Jayasudha, Sándor Kocsubé, Nikolett Baranyi, Coimbatore Subramanian Shobana, Muthusamy Chandrasekaran, Shine Kadaikunnan, Venkatapathy Narendran, Csaba Vágvölgyi, and Palanisamy Manikandan</i>	

32. <i>Candida</i>	497
<i>María Jesús Andrade, Mar Rodríguez, Alicia Rodríguez, and Juan José Córdoba</i>	

33. <i>Enterocytozoon bieneusi</i>	511
<i>Hirotake Mori and Aongart Mahittikorn</i>	

34. <i>Fusarium</i>	523
<i>Palanisamy Manikandan, Coimbatore Subramanian Shobana, Mónika Homa, Sándor Kocsubé, János Varga, Muthusamy Chandrasekaran, Naiyf S. Alharbi, Venkatapathy Narendran, Csaba Vágvölgyi, and László Kredics</i>	

35. <i>Penicillium</i> and <i>Talaromyces</i>	555
<i>Elena Bermúdez, Félix Núñez, Josué Delgado, and Miguel A. Asensio</i>	

Section V Foodborne Infections due to Protozoa

36. <i>Acanthamoeba</i>	579
<i>Dongyou Liu</i>	

37. <i>Cryptosporidium</i>	589
<i>Dongyou Liu</i>	

38. <i>Cystoisospora belli</i>	599
<i>Chaturong Putaporntip and Somchai Jongwutiwes</i>	

39. <i>Entamoeba histolytica</i>	617
<i>Mineko Shibayama, Nidia León-Sicairos, Jesús Serrano-Luna, and Mireya de la Garza</i>	

40. <i>Giardia lamblia</i>	635
<i>Steven M. Singer, Jenny G. Maloney, and Camila H. Coelho</i>	

41. <i>Toxoplasma: Animal and In Vitro Models on Toxoplasmosis</i>	655
<i>Renato Augusto DaMatta, Andrea Cristina Vetö Arnholdt, and Farlen José Beber Miranda</i>	

Section VI Foodborne Infections due to Helminths

42. <i>Anisakis</i>	679
<i>Mauricio Afonso Vericimo, Gerlinde Teixeira, Israel Figueiredo Jr., Janaina Ribeiro, Maria Augusta Moulin Fantezia, and Sergio Carmona São Clemente</i>	
43. <i>Clonorchis sinensis</i>	703
<i>Bayissa Chala Legissa and Sung-Tae Hong</i>	
44. <i>Fasciola</i> and <i>Fasciolosis</i>	717
<i>Antonio Muro and Jose Rojas-Caraballo</i>	
45. <i>Haplorchis</i>	735
<i>Dongyou Liu</i>	
46. <i>Metagonimus</i>	743
<i>Jong-Yil Chai</i>	
47. <i>Opisthorchis viverrini</i>	765
<i>Thidarut Boonmars</i>	
48. <i>Paragonimus</i>	773
<i>Dongyou Liu</i>	
49. <i>Taenia</i>	783
<i>Dongyou Liu</i>	
50. <i>Trichinella</i>	793
<i>Ljiljana Sofronic-Milosavljevic, Natasa Ilic, and Alisa Gruden-Movsesijan</i>	
Index	809