Salmonella Infections
Clinical, Immunological and Molecular Aspects

Salmonella enterica encompasses a diverse range of bacteria that cause a spectrum of diseases in many hosts. Advancements in prevention and treatment of S. enterica infections have at times been hampered by compartmentalization of research efforts and lack of multidisciplinary approaches. This book attempts to cover a diverse range of topics related to the biology of S. enterica infections, including epidemiological and clinical aspects, molecular pathogenesis, immunity to disease and vaccines. Salmonella enterica infections are important zoonoses and therefore material on infections of animals and public health issues have also been considered. Each chapter can be read independently, but the full contents of the book will provide the reader with up-to-date knowledge on all the key aspects of salmonellosis in humans and animals. It will therefore be of interest to graduate students and researchers, as well as to clinicians, whose research focuses on this important pathogen.

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Over the past decade, the rapid development of an array of techniques in the fields of cellular and molecular biology has transformed whole areas of research across the biological sciences. Microbiology has perhaps been influenced most of all. Our understanding of microbial diversity and evolutionary biology and of how pathogenic bacteria and viruses interact with their animal and plant hosts at the molecular level, for example, have been revolutionized. Perhaps the most exciting recent advance in microbiology has been the development of the interface discipline of Cellular Microbiology, a fusion of classic microbiology, microbial molecular biology, and eukaryotic cellular and molecular biology. Cellular Microbiology is revealing how pathogenic bacteria interact with host cells in what is turning out to be a complex evolutionary battle of competing gene products. Molecular and cellular biology are no longer discrete subject areas but vital tools and an integrated part of current microbiological research. As part of this revolution in molecular biology, the genomes of a growing number of pathogenic and model bacteria have been fully sequenced, with immense implications for our future understanding of microorganisms at the molecular level.

Advances in Molecular and Cellular Microbiology is a series edited by researchers active in these exciting and rapidly expanding fields. Each volume will focus on a particular aspect of cellular or molecular microbiology and will provide an overview of the area; it will also examine current research. This series will enable graduate students and researchers to keep up with the rapidly diversifying literature in current microbiological research.
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Salmonella Infections

Clinical, Immunological and Molecular Aspects

EDITED BY
PIETRO MASTROENI AND
DUNCAN MASKELL

University of Cambridge
To our families and friends

TO CARLOS
### Contents

**List of contributors**  
Page xiv

**Preface**  
Page xviii

1 Epidemiological and clinical aspects of human typhoid fever  
1.1 Introduction  
1.2 *Salmonella enterica* serovar Typhi  
1.3 Epidemiology of typhoid fever  
1.4 Pathophysiology of typhoid fever  
1.5 Clinical features of typhoid fever  
1.6 Diagnosis of typhoid fever  
1.7 Management of typhoid fever  
1.8 Control and prevention of typhoid fever  
1.9 Conclusions  
1

2 Antibiotic resistance in *Salmonella* infections  
2.1 Introduction  
2.2 Antibiotic resistance in *S. enterica* serovar Typhi  
2.3 Antibiotic resistance in enteric fevers other than typhoid  
2.4 Antibiotic resistance in non-typhoid *Salmonella enterica* serovars  
2.5 The causes of resistance  
2.6 Conclusions  
25

3 Host-specificity of *Salmonella* infections in animal species  
3.1 Introduction  
3.2 *Salmonella* infections of cattle  
3.3 *Salmonella* infections of pigs  
3.4 *Salmonella* infections of domestic fowl and other avian species  
57
3.5 What are the determinants of Salmonella serovar host-specificity? 73
3.6 Do host-specific serovars use a strategy of stealth to cause systemic disease? 76
3.7 Dissemination of Salmonella to systemic tissues – an evolutionary dead-end or an alternative means of inter-animal spread? 77
3.8 Conclusions 79
3.9 Acknowledgements 80

4 Public health aspects of Salmonella enterica in food production 89
4.1 Introduction and historical perspective 89
4.2 Recent trends in S. enterica infections 90
4.3 Human disease caused by S. enterica and vehicles for its transmission to humans 92
4.4 Animal reservoirs of S. enterica infection 94
4.5 Milk and milk products as vehicles of infection 96
4.6 Meat and meat products and S. enterica 97
4.7 Contamination of poultry meat with S. enterica 98
4.8 Eggs and egg products as vehicles of infection and the S. enterica serovar Enteritidis pandemic 100
4.9 The infectious dose of S. enterica 105
4.10 Conclusions 107

5 The Salmonella genome: a global view 117
5.1 Introduction 117
5.2 Full genome sequences facilitate the study of Salmonella 117
5.3 Comparative genomics: old and new techniques 118
5.4 In silico tools for comparative genomics 119
5.5 Microarray technology as a tool for comparative genomics 120
5.6 Sequenced Salmonella genomes as tools for comparative genomics 121
5.7 In silico analysis of Salmonella genomes and comparisons between genome sequences 124
5.8 Mobile genetic elements: plasmids and bacteriophages 130
5.9 Fimbrial and pilus genes are highly variable between Salmonella genomes 133
5.10 Analysis of Salmonella genomes based on microarray technology 134
5.11 Genome sequences facilitate functional genomics 135
5.12 Conclusions 136
5.13 Acknowledgements 137

6 Pathogenicity islands and virulence of Salmonella enterica 146
6.1 Introduction 146
6.2 Pathogenicity islands of Salmonella 147
6.3 Salmonella Pathogenicity Island 1 148
6.4 Salmonella Pathogenicity Island 2 154
6.5 Salmonella Pathogenicity Island 3 158
6.6 Salmonella Pathogenicity Island 4 159
6.7 Salmonella Pathogenicity Island 5 159
6.8 Salmonella Pathogenicity Island 6 (or Salmonella centisome 7 genomic island) 160
6.9 Salmonella Pathogenicity Island 7 (or Major Pathogenicity Island) 161
6.10 Salmonella Pathogenicity Islands 8 to 10 162
6.11 Salmonella genomic island 1 163
6.12 High Pathogenicity Island 164
6.13 Other SPI of Salmonella? 164
6.14 Conclusions 165
6.15 Acknowledgements 167

7 In vivo identification, expression and function of Salmonella virulence genes 173
7.1 Introduction 173
7.2 Identification of virulence genes in vivo 174
7.3 Regulation of the expression of virulence genes 185
7.4 Functions of virulence genes involved in gastroenteritis and systemic disease 191
7.5 Conclusions 195
7.6 Acknowledgements 195

8 Mechanisms of immunity to Salmonella infections 207
8.1 Introduction 207
8.2 Models for the study of immunity to S. enterica 207
8.3 Early events in the interaction between S. enterica and the immune system 208
8.4 S. enterica reaches the phagocytic cells in the infected tissues 210
8.5 Dynamics of S. enterica spread and distribution at the single cell level 211
8.6 Innate immunity and control of the early growth of S. enterica in the tissues 215
8.7 Progressive bacterial growth in the tissues results in lethal infections 219
8.8 The activation of the adaptive innate immune response and the suppression of bacterial growth in sublethal infections 220
8.9 The clearance of a primary infection requires the presence of T-cells 224
8.10 The initiation and development of antigen-specific immunity 225
8.11 Mechanisms of host resistance in secondary infections 228
8.12 Immunity to S. enterica infection in humans 230
8.13 Conclusions 237
8.14 Acknowledgements 239

9 Interactions of S. enterica with phagocytic cells 255
9.1 Introduction 255
9.2 Interactions of S. enterica with the macrophage endosomal pathways 256
9.3 Innate anti-S. enterica activity of the Nramp1 divalent metal transporter 258
9.4 Oxygen-dependent killing of S. enterica 260
9.5 Activativation of macrophage activity against S. enterica 265
9.6 Conclusions 269
9.7 Acknowledgements 269

10 Interactions between Salmonella and dendritic cells: what happens along the way? 279
10.1 Introduction 279
10.2 Dendritic cells 279
10.3 Dendritic cells and the entry of Salmonella into the host 281
10.4 Dendritic cell interactions with Salmonella in the Peyer’s patches 282
10.5 Dendritic cell interactions with Salmonella in mesenteric lymph nodes 284
10.6 Dendritic cell interactions with Salmonella in the spleen 286
10.7 Dendritic cell interactions with Salmonella in the liver 289
10.8 Conclusions 291
10.9 Acknowledgements 292
11 Immunity to *Salmonella* in domestic (food animal) species 299
11.1 Introduction 299
11.2 Innate immunity 300
11.3 Adaptive immunity 304
11.4 Vaccines against *S. enterica* infections 308
11.5 Live *Salmonella* vaccines as vectors for the delivery of heterologous antigens in domestic species 311
11.6 Protection induced by live *S. enterica* vaccines by non-immune and non-specific immune mechanisms 312
11.7 Conclusions 313

12 Newer vaccines against typhoid fever and gastrointestinal salmonelloses 323
12.1 Introduction 323
12.2 Typhoid vaccines 323
12.3 Vaccines for use against non-typhoidal salmonelloses in humans 329
12.4 Vaccines for use in veterinary species 330
12.5 Novel approaches to the development of *S. enterica* vaccines 332
12.6 Conclusions 332
12.7 Acknowledgements 333

13 *S. enterica*-based antigen delivery systems 337
13.1 Introduction 337
13.2 *S. enterica* expressing heterologous antigens as multivalent vaccines 338
13.3 Expression systems for heterologous antigens in *S. enterica* 338
13.4 Immune responses against heterologous antigens expressed in *S. enterica* 344
13.5 *S. enterica* as a delivery system for DNA vaccines 349
13.6 New emerging applications of *S. enterica* as a vaccine vector 351
13.7 Conclusions 355

Index 371

*The colour plates are situated between pages 206 and 207*
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Salmonella enterica encompasses a diverse range of bacteria that cause a spectrum of diseases in many hosts. Typhoid fever is still a major killer of people in the developing world and rears its ugly head whenever war or natural disaster strikes. The increase in antibiotic resistance that has been observed in Salmonella enterica serovar Typhi makes the understanding of this pathogen ever more important. But typhoid fever is not the only Salmonella-related disease that causes concern, with human gastrointestinal disease a major problem in developed and developing countries, not forgetting salmonellosis in livestock that bring with them economic losses as well as the problems of zoonoses and food-borne disease.

The different salmonellae make up a versatile and fascinating group of organisms that have inspired both of the Editors of this book since we were scientific juveniles studying the pathogenesis and immunity of these bacteria for our Ph.D. degrees. As we have moved through the stages of our scientific careers, other bacteria and immunological questions may have caught our attention for a while, but always the salmonellae persisted, providing the bedrock of our interests and the centrepiece of our scientific enquiries.

So why edit a book on salmonellae now? The easy answer to this question is that the study of the salmonellae is entering a brave new world with the completion of the genome sequences of serovars Typhi, Paratyphi A and Typhimurium, with other sequences hot on their tail. Add to this impetus the remarkable advances in whole genome analysis that have been allied to genome science, and that have especially opened the door on so many of the secrets of how salmonellae cause disease, and it begins to look like a really exciting time to be working with salmonellae. Add again advances in the study of the cellular biology of infection that have been made recently, especially in the context of the marvellous imaging technologies that are now
available, and we begin to move to a position where the diseases caused by salmonellae might be understood at a level of detail unimaginable only ten years ago.

We hope that we have covered most of the key aspects of the biology of Salmonella infections in this book and that we have brought out some of the excitement in the field currently being felt by researchers. We have also been intent on embedding the basic science aspects of this book in real disease states, and so we have enthusiastically included chapters on the clinical diseases and public health problems caused by this group of bacteria.

Finally, science-based vaccines against salmonellae are already a reality. Improvements in our understanding of the immunology and vaccinology of these diseases may not only lead to control of these problems in the future but may also lead in unexpected directions. In fact, this intracellular pathogen can be used as a Trojan horse to introduce antigens from other organisms to a host’s immune system, or indeed deliver other immunotherapeutics that might lead to treatments for a range of non-infectious diseases. We have tried to cover these exciting advances in the book.

It has been a pleasure editing this book, and an enormous education. It would not have been possible without timely and high quality papers from our contributors, to whom we would like to say thank you, and we hope you like the end product. We also hope that you the reader like the book, find it useful and most importantly of all, are enthused by it and by these fascinating organisms.