Staphylococcus

Genetics and Physiology

Edited by

Greg A. Somerville

School of Veterinary Medicine and Biomedical Sciences University of Nebraska-Lincoln Lincoln, NE USA

caister.com/staph2

Copyright © 2016

Caister Academic Press Norfolk, UK

www.caister.com

British Library Cataloguing-in-Publication Data A catalogue record for this book is available from the British Library

ISBN: 978-1-910190-49-4 (paperback) ISBN: 978-1-910190-50-0 (ebook)

Description or mention of instrumentation, software, or other products in this book does not imply endorsement by the author or publisher. The author and publisher do not assume responsibility for the validity of any products or procedures mentioned or described in this book or for the consequences of their use.

All rights reserved. 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 or otherwise, without the prior permission of the publisher. No claim to original U.S. Government works.

Cover design adapted from photographs provided by Dr John 'Dustin' Loy.

Ebooks

Ebooks supplied to individuals are single-user only and must not be reproduced, copied, stored in a retrieval system, or distributed by any means, electronic, mechanical, photocopying, email, internet or otherwise.

Ebooks supplied to academic libraries, corporations, government organizations, public libraries, and school libraries are subject to the terms and conditions specified by the supplier.

Contents

	Contributors	V
	Preface	vii
1	History of <i>Staphylococcus aureus</i> Richard A. Proctor	1
2	Clinical Significance in Humans Mathias Herrmann and Mark S. Smeltzer	23
3	Staphylococcus: Clinical Significance in Animals John Dustin Loy	45
4	Staphylococcal Variation and Evolution Jodi A. Lindsay	67
5	Staphylococcal Virulence Factors Patrick M. Schlievert	81
6	Staphylococcus aureus Metabolism and Physiology Greg A. Somerville	107
7	Physiological Proteomics of Staphylococcus aureus: from the Protein Inventory to Stress Physiology and in vivo Adaptation Susanne Engelmann, Stephan Fuchs and Michael Hecker	119
8	Cell Wall Assembly and Physiology Angelika Gründling	133
9	Transition Metal Ion Homeostasis Jessica R. Sheldon, Ronald S. Flannagan, Mélissa Hannauer and David E. Heinrichs	171
10	Stress Responses in <i>Staphylococcus aureus</i> Dorte Frees and Hanne Ingmer	221
11	Molecular Strategies of <i>Staphylococcus aureus</i> for Resisting Antibiotics Susan Boyle-Vayra and Robert S. Daum	249

iv Contents	caister.com/staph2
12	Genetic Regulation
	Markus Bischoff and Pascale Romby

12	Genetic Regulation	301
	Markus Bischoff and Pascale Romby	
13	Immune Response to <i>Staphylococcus aureus</i> Aisling F. Brown and Rachel M. McLoughlin	335
	Index	389

Preface

In a letter to Robert Hooke, Isaac Newton wrote that "If I have seen further than others, it is by standing upon the shoulders of giants." This quote highlights the fundamental nature of science; specifically, that it is an incremental process based on the cumulative discoveries of generations of scientists. It is with this in mind that the authors of this book have attempted to summarize the progress in *Staphylococcus aureus* research by acknowledging the contributions of scientists past (our mentors), present (our colleagues), and future (our students and post-docs). While we may stand on the shoulders of giants, it is with the understanding that past observations can only be viewed in the present

context with an appreciation for how evolution has changed *S. aureus*. This book provides current perspectives on *S. aureus* clinical significance in humans and animals and how this significance was established through bacterial physiology, genetics, and evolution to influence the host–pathogen interaction through virulence factors, immune modulation, and antibiotic resistance.

As the editor of this book, I am honoured to have worked with such an outstanding group of scientists and I look forward to our future collaborations. Hopefully, at our next scientific gathering, we can all be together and enjoy a glass of wine or beer to celebrate our accomplishment.

Greg A. Somerville, PhD Lincoln, NE, USA