

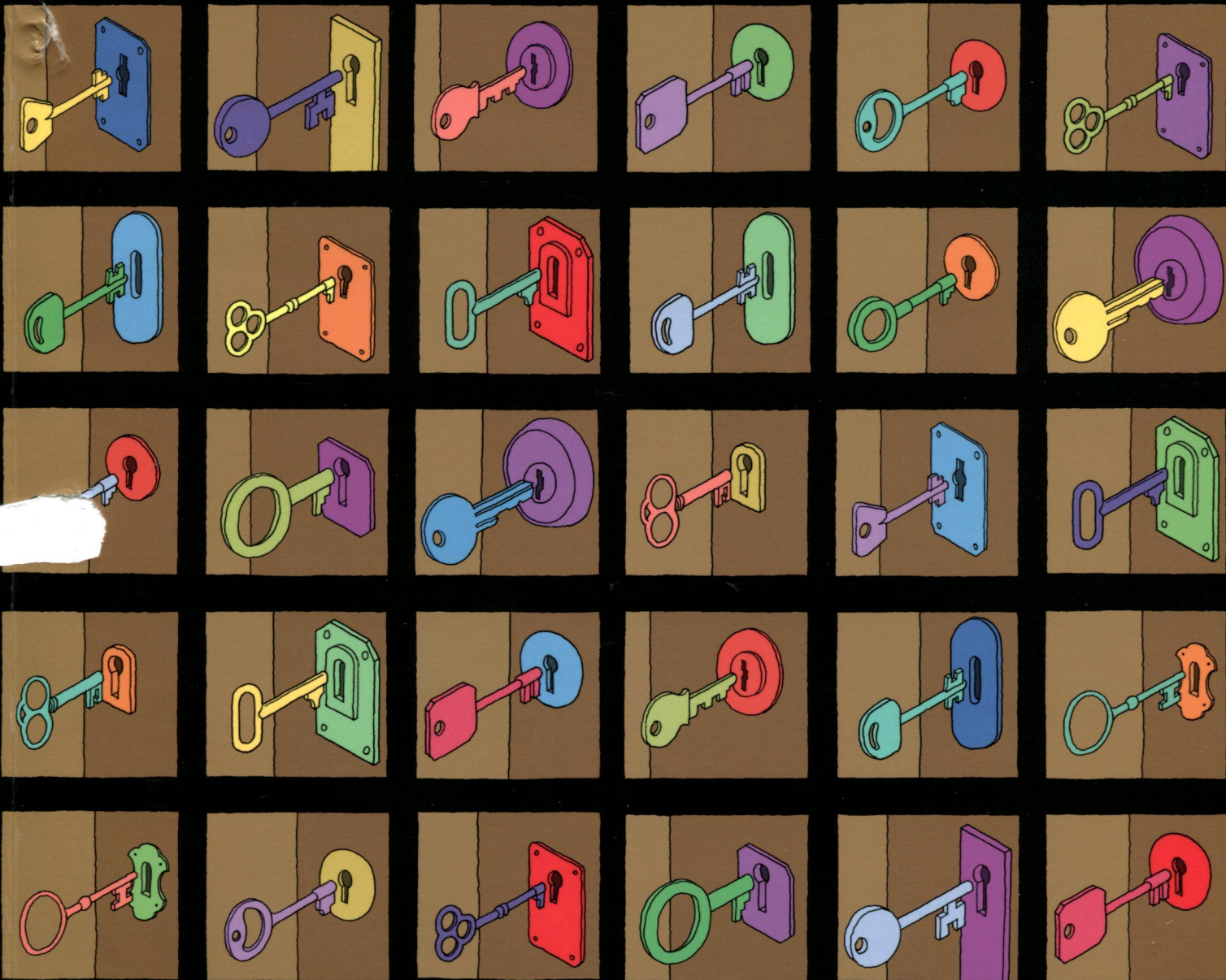
174  
N28/n

# Nature

## REVIEWS

june 2014 volume 12 no. 6  
www.nature.com/reviews

# MICROBIOLOGY

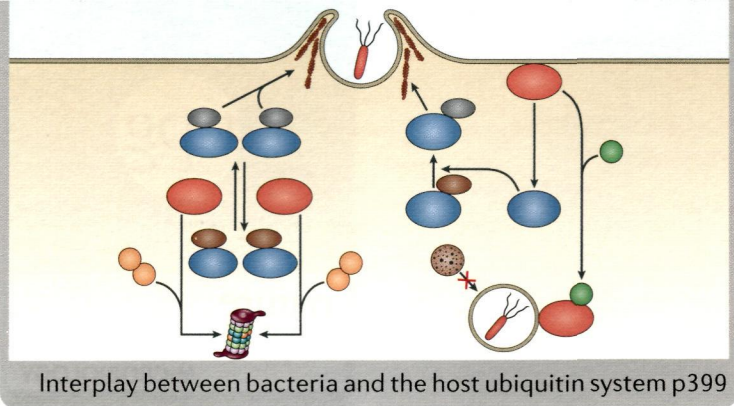


### Multiple keys, multiple locks

A reassessment of archaeal membrane lipid biosynthesis

### IT'S COLD OUT THERE

The microbial ecology of permafrost



# CONTENTS

June 2014  
volume 12 no. 6

## REVIEWS

### 399 Exploitation of the host ubiquitin system by human bacterial pathogens

*Hiroshi Ashida, Minsoo Kim and Chihiro Sasakawa*  
Bacterial pathogens have evolved diverse strategies to interfere with and modulate the ubiquitin systems of the host for their own benefit. In this Review, Sasakawa and colleagues discuss the mechanisms that are involved, with a focus on secreted effector proteins that are delivered into the host cell by human bacterial pathogens.

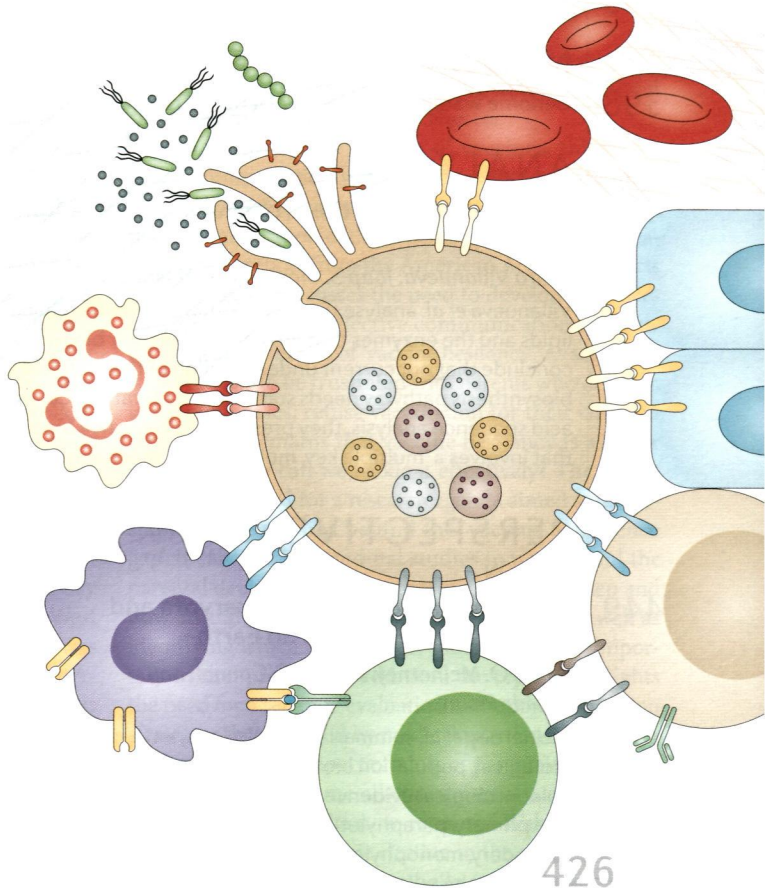
### 414 The microbial ecology of permafrost

FEATURED ARTICLE

*Janet K. Jansson and Neslihan Taş*  
One-quarter of the land surface on Earth is underlain by permafrost. Jansson and Taş review the microbial ecology of this fascinating and unique niche, pulling together observations from the study of permafrost isolates and the application of high-throughput sequencing.

### 426 Platelets: at the nexus of antimicrobial defence

*Michael R. Yeaman*  
Platelets are multifunctional granulocytes that function at the intersection of antimicrobial and haemostatic host defences. Michael R. Yeaman presents an integrated overview of the antimicrobial functions of platelets, which are mediated both directly and indirectly to integrate innate and adaptive immune responses to pathogens.



## On the web [www.nature.com/reviews/micro](http://www.nature.com/reviews/micro)

### Advance online publication

We operate an advance online publication (AOP) service for authors and readers to view the latest articles published online ahead of print.

### Forthcoming articles:

Microbiological effects of sublethal levels of antibiotics  
*Dan I. Andersson and Diarmaid Hughes*

Motility and more: the flagellum of *Trypanosoma brucei*  
*Gerasimos Langousis and Kent L. Hill*

Functional long-range RNA–RNA interactions in plus-strand RNA viruses  
*Beth L. Nicholson and K. Andrew White*

Nature Reviews Microbiology (ISSN 1740-1526) is published monthly by Nature Publishing Group, a division of Macmillan Publishers Ltd, The Macmillan Building, 4 Crinan Street, London N1 9XW, UK. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form (electronic or otherwise) without prior permission from [permissions@nature.com](mailto:permissions@nature.com). US Periodicals postage paid at Jamaica, NY, and additional mailing post offices. US POSTMASTER: Send address changes to Nature Publishing Group, Air Business Ltd, c/o Worldnet Shipping Inc., 156-15, 146th Avenue, 2nd Floor, Jamaica, NY 11434, USA.  
© 2014 Macmillan Publishers Limited. All rights reserved. Printed in United Kingdom.

### Links to further information

The full text of articles includes author biographies, links to glossary terms and links to websites and databases with relevant information.

**Key points** provides a bullet-pointed summary of the main topics covered in each article.

### E-alert table of contents

Get monthly e-mail alerts to the content of this journal — sent FREE to your inbox — by registering online. Or sign up to receive the latest content as an RSS newsfeed by visiting [www.nature.com/reviews/micro](http://www.nature.com/reviews/micro)

### Twitter

Follow *Nature Reviews Microbiology* on Twitter for the latest news from the journal and beyond: @NatureRevMicro

### Online correspondence

Comments from readers about our articles. All correspondence will be highlighted on the table of contents and on e-mail alerts.

Федеральное государственное  
бюджетное учреждение науки  
Центральная научная библиотека  
Уральского отделения

## EDITORIAL

391 Best of times, worst of times

## RESEARCH HIGHLIGHTS

393 Selections from the recent scientific literature

## NEWS & ANALYSIS

398 **Genome watch** TB or not TB? Genomic portraits provide answers

## ANALYSIS

438 **A re-evaluation of the archaeal membrane lipid biosynthetic pathway**

*Laura Villanueva, Jaap S. Sinninghe Damsté and Stefan Schouten*

Villanueva *et al.* analyse the relationship between archaeal membrane lipids and the enzymes that are involved in their biosynthesis and conclude that our current understanding of the archaeal membrane lipid biosynthesis pathway needs some reconsideration. On the basis of amino acid sequence analysis, they present an alternative biosynthetic pathway that involves a 'multiple key, multiple lock' mechanism.

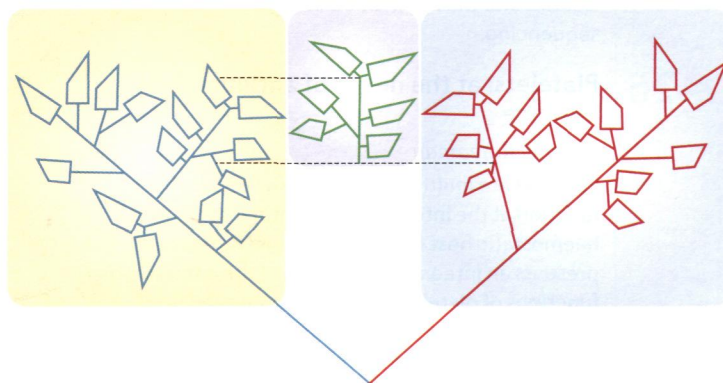
## PERSPECTIVE

OPINION

449 **The hybrid nature of the Eukaryota and a consilient view of life on Earth**

*James O. McInerney, Mary J. O'Connell and Davide Pisani*

McInerney *et al.* summarize the phylogenetic, cell biological, population biology, biochemical and paleontological evidence that cellular life consists of two primary, paraphyletic, prokaryotic groups and one secondary, monophyletic group that has symbiogenic origins — the eukaryotes.



► **COVER:** 'Multiple keys, multiple locks' by Philip Patenall, inspired by the Analysis article on p438.

### EDITORIAL & PRODUCTION OFFICE

The Macmillan Building, 4 Crinan Street, London N1 9XW, UK  
Tel: +44 (0)20 7843 3620  
Email: [NatureReviews@nature.com](mailto:NatureReviews@nature.com)  
[www.nature.com/reviews/micro](http://www.nature.com/reviews/micro)

**CHIEF EDITOR** Sheilagh Molloy  
**SENIOR EDITOR** Christina Tobin Kährström  
**ASSOCIATE EDITOR** Cláudio Nunes-Alves  
**ASSISTANT EDITOR** Andrea Du Toit  
**COPY EDITOR** Jennifer Thorley  
**ART EDITOR** Philip Patenall  
**COPY EDITING MANAGER** Catriona Rodwell  
**SENIOR COPY EDITOR** Mariam Faruqi  
**EDITORIAL ASSISTANTS** Emily Finn, Rebecca Cromie  
**MANAGING PRODUCTION EDITOR** Judith Shadwell  
**SENIOR PRODUCTION EDITOR** Simon Fenwick  
**ART CONTROLLER** Susanne Harris  
**SENIOR ART EDITORS** Patrick Morgan, Vicky Summersby  
**PRODUCTION CONTROLLER** Natalie Smith  
**EXECUTIVE EDITOR** Arianne Heinrichs  
**EDITORIAL DIRECTOR** Alison Mitchell

**CUSTOMER SERVICES** [www.nature.com/help](http://www.nature.com/help)  
**PERSONAL SUBSCRIPTIONS** [subscriptions@nature.com](mailto:subscriptions@nature.com)  
**REPRINTS** [www.nature.com/reprints](http://www.nature.com/reprints)  
**ADVERTISING & SPONSORSHIP**  
[www.nature.com/advertising](http://www.nature.com/advertising)  
**SITE LICENCES**  
[www.nature.com/libraries/site\\_licenses/index.html](http://www.nature.com/libraries/site_licenses/index.html)  
**PRESS OFFICE** [press@nature.com](mailto:press@nature.com)  
**MARKETING** [marketing@nature.com](mailto:marketing@nature.com)

### MANAGEMENT OFFICES

**NPG LONDON** The Macmillan Building, 4 Crinan Street, London N1 9XW, UK. Tel: +44 (0)20 7833 4000  
**NPG NEW YORK** 75 Varick Street, 9th floor, New York, NY 10013-1917, USA. Tel: +1 212 726 9200  
**NPG ASIA-PACIFIC** Chiyoda Building 2-37 Ichigayatamachi, Shinjuku-Ku, Tokyo 16200843, Japan. Tel: +1 212 726 9200  
A list of other offices can be found at [www.nature.com/npg\\_/contact/offices.html](http://www.nature.com/npg_/contact/offices.html)

Copyright © 2014 Nature Publishing Group  
Printed in Wales by Cambrian Printers on acid-free paper.

### EDITORS



SHEILAGH MOLLOY



CHRISTINA TOBIN KÄHRSTRÖM



CLÁUDIO NUNES-ALVES



ANDREA DU TOIT