

# IAI

## INFECTION AND IMMUNITY

MARCH 2014  
VOLUME 82  
NUMBER 3



published monthly by



AMERICAN  
SOCIETY FOR  
MICROBIOLOGY

## TABLE OF CONTENTS

### SPOTLIGHT

|  |     |
|--|-----|
| Articles of Significant Interest Selected from This Issue by the Editors | 915 |
|--|-----|

### COMMENTARIES

|   |                   |         |
|---|-------------------|---------|
| Statistics in <i>Infection and Immunity</i> Revisited | Cara H. Olsen     | 916–920 |
| Inside Scoop on Outside Proteins                      | Jeffrey D. Dvorin | 921–923 |

### MOLECULAR PATHOGENESIS

|   |   |           |
|---|---|-----------|
| High-Temperature Protein G Is an Essential Virulence Factor of <i>Leptospira interrogans</i>  | Amy M. King, Gabriela Pretre, Thanatchaporn Bartpho, Rasana W. Serm Swan, Claudia Toma, Toshihiko Suzuki, Azad Eshghi, Mathieu Picardeau, Ben Adler, Gerald L. Murray | 1123–1131 |
| Novel Role for the <i>yceGH</i> Tellurite Resistance Genes in the Pathogenesis of <i>Bacillus anthracis</i>   | Sarah E. Franks, Celia Ebrahimi, Andrew Hollands, Cheryl Y. Okumura, Raffi V. Aroian, Victor Nizet, Shauna M. McGillivray   | 1132–1140 |
| The Phosphoenolpyruvate Phosphotransferase System in Group A <i>Streptococcus</i> Acts To Reduce Streptolysin S Activity and Lesion Severity during Soft Tissue Infection                     | Kanika Gera, Tuquynh Le, Rebecca Jamin, Zehava Eichenbaum, Kevin S. McIver  | 1192–1204 |
| Oral Intoxication of Mice with Shiga Toxin Type 2a (Stx2a) and Protection by Anti-Stx2a Monoclonal Antibody 11E10   | L. M. Russo, A. R. Melton-Celsa, M. A. Smith, M. J. Smith, A. D. O'Brien  | 1213–1221 |
| Three Antagonistic Cyclic di-GMP-Catabolizing Enzymes Promote Differential Dot/Icm Effector Delivery and Intracellular Survival at the Early Steps of <i>Legionella pneumophila</i> Infection | Julie Allombert, Jean-Claude Lazzaroni, Nathalie Bailo, Christophe Gilbert, Xavier Charpentier, Patricia Doublet, Anne Vianney  | 1222–1233 |
| Requirement of the <i>Pseudomonas aeruginosa</i> CbrA Sensor Kinase for Full Virulence in a Murine Acute Lung Infection Model   | Amy T. Y. Yeung, Laure Janot, Olga M. Pena, Anke Neidig, Irena Kukavica-Ibrulj, Ashley Hilchie, Roger C. Levesque, Joerg Overhage, Robert E. W. Hancock               | 1256–1267 |
| Extensive Variation and Rapid Shift of the MG192 Sequence in <i>Mycoplasma genitalium</i> Strains from Patients with Chronic Infection  | Liang Ma, Miriam Mancuso, James A. Williams, Barbara Van Der Pol, J. Dennis Fortenberry, Qiuyao Jia, Leann Myers, David H. Martin                                     | 1326–1334 |

### CELLULAR MICROBIOLOGY: PATHOGEN-HOST CELL MOLECULAR INTERACTIONS

|  |   |           |
|--|---|-----------|
| Janus Kinase 3 Activity Is Necessary for Phosphorylation of Cytosolic Phospholipase A2 and Prostaglandin E2 Synthesis by Macrophages Infected with <i>Francisella tularensis</i> Live Vaccine Strain | Ashley M. Brummett, Aaron R. Navratil, Joshua D. Bryan, Matthew D. Woolard                            | 970–982   |
| <i>Chlamydia trachomatis</i> -Infected Epithelial Cells and Fibroblasts Retain the Ability To Express Surface-Presented Major Histocompatibility Complex Class I Molecules                           | Danny Kägebein, Melanie Gutjahr, Christina Große, Annette B. Vogel, Jürgen Rödel, Michael R. Knittler | 993–1006  |
| BsaB, a Novel Adherence Factor of Group B <i>Streptococcus</i>   | Shengmei Jiang, Michael R. Wessels  | 1007–1016 |

|  |  |           |
|--|--|-----------|
| <b>Assembly of NADPH Oxidase in Human Neutrophils Is Modulated by the Opacity-Associated Protein Expression State of <i>Neisseria gonorrhoeae</i></b>      | Asya Smirnov, Kylene P. Daily,<br>Alison K. Criss  | 1036–1044 |
| <b>Fluxes of Ca<sup>2+</sup> and K<sup>+</sup> Are Required for the Listeriolysin O-Dependent Internalization Pathway of <i>Listeria monocytogenes</i></b> | Stephen Vadia, Stephanie Seveau  | 1084–1091 |
| <b>The Nod1, Nod2, and Rip2 Axis Contributes to Host Immune Defense against Intracellular <i>Acinetobacter baumannii</i> Infection</b>                     | Pradeep Bist, Neha Dikshit, Tse Hsien Koh, Alessandra Mortellaro, Thuan Tong Tan, Bindu Sukumaran  | 1112–1122 |
| <b><i>Yersinia pseudotuberculosis</i> Efficiently Escapes Polymorphonuclear Neutrophils during Early Infection</b>   | Linda Westermarck, Anna Fahlgren,<br>Maria Fällman   | 1181–1191 |
| <b>Role of Epidermal Growth Factor Receptor Signaling in the Interaction of <i>Neisseria meningitidis</i> with Endothelial Cells</b>                       | Heiko Slanina, Sabrina Mündlein,<br>Sabrina Hebling, Alexandra Schubert-Unkmeir  | 1243–1255 |
| <b>Identification of a Crucial Residue Required for <i>Staphylococcus aureus</i> LukAB Cytotoxicity and Receptor Recognition</b>                           | Ashley L. DuMont, Pauline Yoong,<br>Xiang Liu, Christopher J. Day,<br>Nicole M. Chumbler, David B. A. James, Francis Alonzo III, Nadine J. Bode, D. Borden Lacy, Michael P. Jennings, Victor J. Torres | 1268–1276 |
| <b>BACTERIAL INFECTIONS</b>  |  |           |
| <b>Essential Role of Invasin for Colonization and Persistence of <i>Yersinia enterocolitica</i> in Its Natural Reservoir Host, the Pig</b>                 | Julia Schaake, Anna Drees, Petra Grüning, Frank Uliczka, Fabio Pisano,<br>Tanja Thiermann, Alexandra von Altrock, Frauke Seehusen, Peter Valentin-Weigand, Petra Dersch                                | 960–969   |
| <b>Reduced Live Organism Recovery and Lack of Hydrosalpinx in Mice Infected with Plasmid-Free <i>Chlamydia muridarum</i></b>                               | Lei Lei, Jianlin Chen, Shuping Hou,<br>Yiling Ding, Zhangsheng Yang, Hao Zeng, Joel Baseman, Guangming Zhong   | 983–992   |
| <b>Biofilm Matrix Exoproteins Induce a Protective Immune Response against <i>Staphylococcus aureus</i> Biofilm Infection</b>                               | Carmen Gil, Cristina Solano, Saioa Burgui, Cristina Latasa, Begoña García,<br>Alejandro Toledo-Arana, Iñigo Lasa, Jaione Valle   | 1017–1029 |
| <b>Cooperation, Quorum Sensing, and Evolution of Virulence in <i>Staphylococcus aureus</i></b>   | Eric J. G. Pollitt, Stuart A. West,<br>Shanika A. Crusz, Maxwell N. Burton-Chellew, Stephen P. Diggle  | 1045–1051 |
| <b>The <i>Bordetella bronchiseptica</i> Type III Secretion System Is Required for Persistence and Disease Severity but Not Transmission in Swine</b>       | Tracy L. Nicholson, Susan L. Brockmeier, Crystal L. Loving, Karen B. Register, Marcus E. Kehrl, Jr., Sarah M. Shore  | 1092–1103 |
| <b>Biofilm Formation Enhances Fomite Survival of <i>Streptococcus pneumoniae</i> and <i>Streptococcus pyogenes</i></b>                                     | Laura R. Marks, Ryan M. Reddinger,<br>Anders P. Hakansson  | 1141–1146 |
| <b><i>Filifactor alocis</i> Infection and Inflammatory Responses in the Mouse Subcutaneous Chamber Model</b>   | Qian Wang, Ravi Jotwani, Junyi Le,<br>Jennifer L. Krauss, Jan Potempa,<br>Susan C. Coventry, Silvia M. Uriarte,<br>Richard J. Lamont   | 1205–1212 |
| <b>Children with Invasive <i>Staphylococcus aureus</i> Disease Exhibit a Potently Neutralizing Antibody Response to the Cytotoxin LukAB</b>                | Isaac P. Thomsen, Ashley L. DuMont,<br>David B. A. James, Pauline Yoong,<br>Benjamin R. Saville, Nicole Soper,<br>Victor J. Torres, C. Buddy Creech  | 1234–1242 |

## HOST RESPONSE AND INFLAMMATION

- Salmonella enterica* Serovar Typhimurium Infection-Induced CD11b<sup>+</sup> Gr1<sup>+</sup> Cells Ameliorate Allergic Airway Inflammation** Venkateswaran Ganesh, Abdul Mannan Baru, Christina Hesse, Christin Friedrich, Silke Glage, Melanie Gohmert, Christine Jänke, Tim Sparwasser 1052–1063
- Role of Dectin-2 for Host Defense against Systemic Infection with *Candida glabrata*** Daniela C. Ifrim, Judith M. Bain, Delyth M. Reid, Marije Oosting, Ineke Verschueren, Neil A. R. Gow, J. Han van Krieken, Gordon D. Brown, Bart-Jan Kullberg, Leo A. B. Joosten, Jos W. M. van der Meer, Frank Koentgen, Lars P. Erwig, Jessica Quintin, Mihai G. Netea 1064–1073
- Uropathogenic *Escherichia coli* Modulates Innate Immunity To Suppress Th1-Mediated Inflammatory Responses during Infectious Epididymitis** Tali Lang, Christoph Hudemann, Svetlin Tchatalbachev, Angelika Stammler, Vera Michel, Ferial Aslani, Sudhanshu Bhushan, Trinad Chakraborty, Harald Renz, Andreas Meinhardt 1104–1111
- NOS2 Variants Reveal a Dual Genetic Control of Nitric Oxide Levels, Susceptibility to *Plasmodium* Infection, and Cerebral Malaria** Maria de Jesus Trovoada, Madalena Martins, Riadh Ben Mansour, Maria do Rosário Sambo, Ana B. Fernandes, Lígia Antunes Gonçalves, Artur Borja, Roni Moya, Paulo Almeida, João Costa, Isabel Marques, M. Paula Macedo, António Coutinho, David L. Narum, Carlos Penha-Gonçalves 1287–1295
- TREM-1 Promotes Survival during *Klebsiella pneumoniae* Liver Abscess in Mice** Yi-Tsung Lin, Kai-Yu Tseng, Yi-Chen Yeh, Fu-Chen Yang, Chang-Phone Fung, Nien-Jung Chen 1335–1342

## FUNGAL AND PARASITIC INFECTIONS

- Sequential Processing of Merozoite Surface Proteins during and after Erythrocyte Invasion by *Plasmodium falciparum*** Michelle J. Boyle, Christine Langer, Jo-Anne Chan, Anthony N. Hodder, Ross L. Coppel, Robin F. Anders, James G. Beeson 924–936
- Interleukin-17A Enhances Host Defense against Cryptococcal Lung Infection through Effects Mediated by Leukocyte Recruitment, Activation, and Gamma Interferon Production** Benjamin J. Murdock, Gary B. Huffnagle, Michal A. Olszewski, John J. Osterholzer 937–948
- Rosetting *Plasmodium falciparum*-Infected Erythrocytes Bind to Human Brain Microvascular Endothelial Cells *In Vitro*, Demonstrating a Dual Adhesion Phenotype Mediated by Distinct *P. falciparum* Erythrocyte Membrane Protein 1 Domains** Yvonne Adams, Pongsak Kuhnrae, Matthew K. Higgins, Ashfaq Ghumra, J. Alexandra Rowe 949–959
- Interleukin-17-Induced Protein Lipocalin 2 Is Dispensable for Immunity to Oral Candidiasis** Maria Carolina Ferreira, Natasha Whibley, Anna J. Mamo, Ulrich Siebenlist, Yvonne R. Chan, Sarah L. Gaffen 1030–1035
- Low-Dose Intradermal Infection with *Trypanosoma congolense* Leads to Expansion of Regulatory T Cells and Enhanced Susceptibility to Reinfection** Chukwunonso Onyilagha, Ifeoma Okwor, Shiby Kuriakose, Rani Singh, Jude Uzonna 1074–1083
- Neither Dectin-2 nor the Mannose Receptor Is Required for Resistance to *Coccidioides immitis* in Mice** Suganya Viriyakosol, Maria del Pilar Jimenez, Sinobu Saijo, Joshua Fierer 1147–1156
- Plasmodium berghei* Sporozoites Acquire Virulence and Immunogenicity during Mosquito Hemocoel Transit** Yuko Sato, Georgina N. Montagna, Kai Matuschewski 1164–1172

|  |   |           |
|--|---|-----------|
| <b>The Adaptor CARD9 Is Required for Adaptive but Not Innate Immunity to Oral Mucosal <i>Candida albicans</i> Infections</b>   | Shrinivas Bishu, Nydiaris Hernández-Santos, Michelle R. Simpson-Abelson, Anna R. Huppler, Heather R. Conti, Nico Ghilardi, Anna J. Mamo, Sarah L. Gaffen  | 1173–1180 |
| <b>Interleukin-3-Deficient Mice Have Increased Resistance to Blood-Stage Malaria</b>   | Sarah R. Auclair, Kenneth E. Roth, Bryan L. Saunders, Kathryn M. Ogborn, Abdalla A. Sheikh, Julianne Naples, Anna Marie P. Young, Dorottya K. Boisen, Amelia T. Tavangar, Jane E. Welch, Chris S. Lantz                                   | 1308–1314 |
| <b>Eosinophil Deficiency Compromises Lung Defense against <i>Aspergillus fumigatus</i></b>   | Lauren M. Lilly, Michaela Scopel, Michael P. Nelson, Ashley R. Burg, Chad W. Dunaway, Chad Steele   | 1315–1325 |
| <b><i>Toxoplasma gondii</i> Upregulates Interleukin-12 To Prevent <i>Plasmodium berghei</i>-Induced Experimental Cerebral Malaria</b>  | Erik W. Settles, Lindsey A. Moser, Tajie H. Harris, Laura J. Knoll  | 1343–1353 |
| <b>MICROBIAL IMMUNITY AND VACCINES</b>   |   |           |
| <b>Nonfunctional Variant 3 Factor H Binding Proteins as Meningococcal Vaccine Candidates</b>   | Stijn van der Veen, Steven Johnson, Ilse Jongerius, Talat Malik, Alessia Genovese, Laura Santini, David Staunton, Rafael L. Ufret-Vincenty, Matthew C. Pickering, Susan M. Lea, Christoph M. Tang   | 1157–1163 |
| <b>Efficacy of a <i>Plasmodium vivax</i> Malaria Vaccine Using ChAd63 and Modified Vaccinia Ankara Expressing Thrombospondin-Related Anonymous Protein as Assessed with Transgenic <i>Plasmodium berghei</i> Parasites</b> | Karolis Bauza, Tomas Malinauskas, Claudia Pfander, Burcu Anar, E. Yvonne Jones, Oliver Billker, Adrian V. S. Hill, Arturo Reyes-Sandoval  | 1277–1286 |
| <b>Invasion-Inhibitory Antibodies Elicited by Immunization with <i>Plasmodium vivax</i> Apical Membrane Antigen-1 Expressed in <i>Pichia pastoris</i> Yeast</b>  | Elaine C. Vicentin, Kátia S. Franoso, Mariana V. Rocha, Dmitri Iourtov, Fernanda L. dos Santos, Flávia S. Kubrusly, Maria A. Sakauchi, Isaias Raw, Francois Nosten, Laurent Rénia, Mauricio M. Rodrigues, Bruce Russell, Irene S. Soares | 1296–1307 |
| <b>AUTHOR CORRECTION</b>   |   |           |
| <b>Periodontal Treatment Downregulates Protease-Activated Receptor 2 in Human Gingival Crevicular Fluid Cells</b>  | Vanessa Tubero Euzebio Alves, Henrique Aparecido Bueno da Silva, Bruno Nunes de França, Rosangela Santos Eichler, Luciana Saraiva, Maria Helena Catelli de Carvalho, Marinella Holzhausen   | 1354      |

Cover photograph (Copyright © 2014, American Society for Microbiology. All Rights Reserved.): A C57BL/6 mouse was treated with corticosteroids and infected sublingually with the commensal fungus *Candida albicans*. Image shows oral thrush lesions on the tongue and buccal mucosa 5 days postinfection. (Photo courtesy of Mira Edgerton, University at Buffalo, State University of New York, Buffalo, NY.) (See related article on p. 1173.)