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Editorial

Editorial: Pertussis: current problems, challenges and investigations of a re-emerging disease

It is an honor to act as editor for this thematic issue of Pathogens and Disease focusing on pertussis, also known as whooping cough (http://femspd.oxfordjournals.org/content/thematic-issue-pertussis). Pertussis is caused by acute respiratory infection with the bacterial pathogen *Bordetella pertussis*, with some cases caused by the related pathogen *B. parapertussis*. The number of pertussis cases was dramatically reduced by introduction of the whole cell pertussis vaccine during the last century, but since introduction of less reactogenic acellular vaccines over the last 20 years, the number of cases has risen substantially in several countries. In 2012, the U.S. had the highest number of pertussis cases since 1955 (just a few years after introduction of the whole cell vaccine). Pertussis is probably the only vaccine-preventable disease that is currently on the rise!

Several factors are thought to be leading contributors to the re-emergence of pertussis, as discussed in several of these reviews. However, perhaps the most significant contributing factor is our relative lack of understanding the basics of pertussis infection, immunity and disease. We are still unsure of which specific immune responses are protective against *B. pertussis* infection and disease in humans and how to elicit protective responses through vaccination. In addition, although several virulence factors of this pathogen have been extensively studied, we still have a poor understanding of their specific roles in infection and the pathogenesis of pertussis disease. This is reflected by the complete lack of effective treatments for pertussis, especially at the paroxysmal coughing stage, and by continued fatalities from pertussis in young infants despite hospitalization and intensive care. Continued basic research on this pathogen and the disease it causes is essential for the development of improved vaccines and therapies.

The reviews in this issue cover a range of topics that are under current investigation in the pertussis field. The current situation of increasing outbreaks of pertussis and how to control it through vaccination and other strategies is discussed in the articles by Guiso, Bolotin, and Hozbor and their colleagues. Discussion of immune responses to pertussis in humans, animal models and specific cell types, and how they bear on vaccine development and epidemiology of disease is covered in the articles by Mills, van Els, Ausiello, and Hewlett and their colleagues. The role of specific virulence factors is discussed in the articles by Cotter and colleagues and Carbonetti. Other topics covered are: seroepidemiology in relation to vaccination, by He and colleagues; strain evolution assessed by genomics, by Preston and colleagues; transmission of infection, by Merkel and colleagues; and potential therapies for pertussis disease, by Carbonetti and colleagues.

However, these reviews provide more questions than answers. For example, which immune responses are most protective against infection as well as disease, and how reliable are animal models of pertussis in determining this? Should we develop a completely new vaccine, change the adjuvant in existing vaccines, or revert to the whole cell vaccine? Should vaccination schedules and strategies be modified? How can diagnosis and surveillance be improved, and are we significantly underestimating the extent of pertussis infection in human populations? Which genetic changes in currently circulating strains increase pathogenicity or fitness in the face of vaccine-elicited immunity? How can our understanding of virulence and disease pathogenesis lead to development of novel effective therapies? These and many other questions require continued and increased basic research in this field, and we hope that young investigators will be attracted to this topic to address some of these questions (and that this issue of Pathogens and Disease contributes to that goal).

Finally, I'd like to thank my Pathogens and Disease editorial colleague and bacterial pathogen investigator, Dave Rasko, for his assistance as a guest editor for a couple of these review articles.

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