

## Emerging viruses

### Editorial overview

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For a complete overview see the [Issue](#)

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W. Ian Lipkin is the John Snow Professor of Epidemiology, Professor of Neurology & Pathology, and Director of the Center for Infection and Immunity (CII) at Columbia University. His contributions include the first use of subtractive cloning and deep sequencing in pathogen discovery. The CII is dedicated to promoting global health through research and training programs focused on gene–environment interactions in health and disease, and by promoting public support for science.

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Ab Osterhaus is the Head of the Department of Viroscience at Erasmus Medical Center Rotterdam with currently about 150 employees, including post-docs, MDs, and PhD students. He has a broad experience in leading research projects in the fields immunopathogenesis of virus infections of man and animals and vaccine development. He holds many editorial appointments for scientific journals, is the holder of several patents, has been the mentor of more than 60 PhD students and from 1980 onwards has held over 50 consultantships. Over the last 25 years, Prof. Osterhaus and his group have identified more than a 20 ‘new’ viral pathogens of humans and animals. He is author of more than 1000 peer reviewed scientific papers.

The winter of 2012/2013 marks the tenth anniversary of the advent of SARS and an opportune milestone to prompt an inventory of how science, industry and public policy have evolved in the aftermath of this first emerging pandemic of the 21st century. It also marked the first successful intervention in human history that allowed the abrogation of an emerging pandemic. There have been substantive improvements since 2003 that provide grounds for even greater optimism. As highlighted in several articles in this issue, the One Health Initiative that promotes co-equal collaborations between practitioners and researchers in human and comparative medicine, and surveillance programs in wildlife and domestic animals as well as humans, has achieved credibility and is building in momentum. There is increasing recognition that infectious diseases do not respect borders and that information concerning threats to health cannot and should not be contained. Accordingly, in 2005, all 194 member states of the United Nations approved the International Health Regulations (IHR) thereby committing to enhancement of national, regional and global public health security by reviewing their surveillance and response capacities and ensuring that those core capacities were functional by 2012. An ideal example of this commitment was the establishment in that same year of the European Centre of Disease Prevention and Control. Some of our authors were instrumental in developing support for the establishment of this Centre and continue to support its mission. The ambitious goals of the IHR have not yet been achieved; nonetheless, wealthier member states are supporting their counterparts in the developing world through training and technology transfer programs. Dramatic reductions in costs for high throughput diagnostics and sequencing have enabled extraordinary advances in surveillance and discovery resulting in unprecedented insights into microbial ecology, evolution and pathogenesis. New clinical and virological surveillance systems have been developed as well as platforms for characterizing host factors that impact vulnerability to infectious diseases and for high throughput therapeutic small molecule discovery. There is growing appreciation that industrial vaccine and antiviral production and regulation has not kept pace with advances in technology as indicated by the approval at the end of 2012 by the United States Food and Drug Administration of the first cell-based influenza vaccine.

This issue of Emerging Viruses includes a series of nine reviews on the status of research and public health preparedness for the inevitable emergence and re-emergence of infectious threats to human health.

Over 70% of emerging infectious diseases are zoonotic in origin, i.e. infectious diseases that originate in wildlife or domestic animals and jump species to cause human disease either directly or via phlebotomous arthropods. In many instances further adaptation to the human species increases the transmissibility and may change pathogenicity. In ‘Reservoirs and

vectors of emerging viruses' Mackenzie and Jeggo provide a comprehensive review of the role of different host species and vectors as drivers of infectious disease emergence. Their discussion of programs focused on proactively identifying potential risks to human health dovetails with Holmes' contribution, entitled 'What can we predict about viral evolution and emergence?' Holmes takes a sobering look at our prospects for predicting infectious disease emergence. Some readers may be discouraged by the complexity of factors that must be employed in modeling and the examples where outcomes could not be predicted through genetic considerations alone; however, he points to solutions that are rooted in use of ecological principles.

Two articles provide public health perspectives. 'Surveillance strategy for early detection of unusual infectious disease events' by Koopmans addresses the challenge of surveillance and response from a public health perspective and presents algorithms that will be helpful, particularly for basic scientists and clinicians, in understanding the process employed by their colleagues focuses on infection control at the population level. Nguyen-Van-Tam and Sellwood, in 'Intervention strategies for emerging respiratory virus infections: policy and public health considerations', complements Koopman's article on surveillance by tackling the consequences of infectious disease outbreaks and providing insights into methods for risk assessment and risk containment.

Diagnostics and discovery are integral to surveillance. In 'Viral surveillance and discovery' Lipkin and Firth review advances in molecular methods for detecting known and novel agents in medicine and public health, the holes in our diagnostic armamentarium (including high throughput serology), the use social media to promote situational awareness and the challenges in moving beyond the finding of the footprint of a virus to implicating it in disease.

Animal models are essential for testing the significance of associations found through efforts in pathogen discovery and in developing strategies for preventing and mitigating disease. In 'Animal models for highly pathogenic emerging viruses', Safronetz, Geisbert and Feldmann describe the process of selecting and implementing animal models for studies of pathogenesis and development of medical countermeasures with specific focus on the strengths and limitations of rodent and nonhuman

primate systems. The work is particularly timely given recent restriction of the use of nonhuman primates for biomedical research.

García-Sastre and Mena discuss the status of viral vaccinology and future prospects for improvement in 'Novel vaccine strategies against emerging viruses'. This remarkably compact paper provides an introduction to a wide range of platforms including attenuated viruses, subunit and peptide vaccines, virus and bacterium-vectored vaccines, viral particles, DNA vaccines; discusses adjuvants and delivery systems and provides insights into the strengths, weaknesses and potential utility of the different strategies.

Debing, Jochmans and Neyts provide a review of therapeutics in 'Intervention strategies for emerging viruses; use of antivirals'. This remarkably detailed yet compact and accessible paper provides updates on drug development for flavi-, entero-, alpha-, corona-, paramyxov-, rhabdo-, arena-, bunya-, filo- and rhabdoviruses.

In 'Virus discovery: one step beyond', Smits and Osterhaus provide specific examples that underscore the importance of integrating global human and veterinary research across a wide range of disciplines. The description of work on the novel coronavirus that recently emerged on the Saudi Peninsula provides a paradigm for rapidly moving from pathogen discovery to receptor identification and studies focused on pathogenesis and developing strategies for intervention. They close with an interim report on the success of European initiatives designed to enable cutting edge infectious disease research.

Although this issue comes to print more than a year after its conception, the data and perspectives are fresh. The authors and editors have continuously reviewed and revised the text such that the final product reflects modifications within a few weeks of closing the issue. We wish we could claim credit for doing this by design; however, the truth is that this benefit for you the reader is due solely to procrastination in New York and Rotterdam.

All best wishes,  
W Ian Lipkin and Ab Osterhaus

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