PANORAMA

↘ New tools to confront future biothreats

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We live in an era when the threat posed by emerging viral diseases is unprecedented in human history. Viruses that we have never seen before emerge with increasing frequency, driven by our expanding population, surging global travel, and our domination of the environment.

We live in fear of a new pathogen suddenly emerging and sweeping through every household, through every community, irrespective of borders or social and economic standing. This fear alone can cost billions, as we saw in the panic and social breakdown caused by Ebola and Zika virus. This is heightened by decades of living with the HIV–AIDS pandemic, our inability to rapidly control West African Ebola, and in the disturbing images of Zika's pathology. Yet the world remains unable to predict when, where, or from what species the next emerging virus will break out.

However, the dire consequences of severe acute respiratory syndrome (SARS), avian flu, 'swine' flu, Ebola, Middle East respiratory syndrome (MERS) and Zika virus are, the authors believe, avoidable. Successfully preventing pandemics and the uncontrolled spread of epidemic viruses, such as Ebola, requires us to think and act differently.

Rapid advances in health science and a technology revolution allow us, for the first time, to imagine a world without emerging viral threats

The problem with emerging threats is that they originate in a seemingly endless pool of viruses carried by our relatives in the animal kingdom. We already know some of these – HIV, which spilled over from chimpanzees to people to cause the AIDS pandemic, Ebola carried by bats in Africa. But recent estimates put the total number of animal viruses that could threaten us at more than 1.5 million, spanning 24 viral families [1, 2]. Compared to the more than 260 viruses known from humans, this viral dark matter represents 99.9% of the potential pandemic threat. It means that, for every known strain of Ebola virus, there are likely tens of thousands of unknown 'Ebola-like' viruses circulating in wildlife that could emerge in the future. The same holds for HIV and retroviruses, SARS and coronaviruses, and Zika and flaviviruses. Importantly, these novel viruses are a threat not only to human populations but to livestock as well, as we see repeatedly with avian flu, and they pose significant challenges to food safety and food security.

> ## We can prepare for emerging viruses before they jump to us

The Global Virome Project (GVP) is designed to target this vast pool of 'unknown' future threats [3]. GVP is a coordinated global partnership to document and characterise the vast majority of the planet's viruses that could threaten people. The vision is that if we can do this in wildlife – their natural hosts – we can prepare for viruses before they jump to us. This will transform our public health culture from one that responds to the latest outbreak, to one that predicts and prevents future pandemic and epidemic threats. The volume of new data produced by the GVP will enable disruptive approaches for the development of biomedical and non-medical countermeasures.

Imagine how Big Data virology could transform vaccine and drug development. Tens of thousands of new viruses will allow biotechnology to move from single viral therapeutics and vaccines to those that target a whole family of viruses. In addition, as we build up a picture of every virus's ecologic profile – which species it infects, where on the planet it is found, which communities and their livestock are exposed to it – we can target our vaccines and drugs to the people on the front line of the next emerging disease.

The GVP will do for emerging viral threats what the Human Genome Project is just beginning to do for personalised

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medicine. With it will come an even greater return on investment because pandemics and uncontrolled epidemics do not just cause sickness, misery and death. They also affect a global economy that is increasingly dependent on open borders, free trade and the global movement of goods and services.

At the core of the GVP is an international alliance that will produce the next generation of local scientists, and promote equitable access to data and benefits. With global support for the GVP, the world will be better prepared to deal with the escalating spillover of deadly viruses. In short, the outcome of the GVP will be the beginning of the end of the Pandemic Era.

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DOSSIER

The Global Virome Project

The power of Big Data – ending the threat from emerging viral diseases

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