New tools: A worker disinfects a road in Liberia last week as part of the fight against Ebola. Scientific advances are being used to better understand it and other infectious diseases. Photo: REUTERS,

New weapons in global war

We need to stay ahead in the evolutionary arms race writes **Nigel French**.

THE ongoing outbreak of Ebola in West Africa reminds us that the battle against infectious disease is far from won. New infectious diseases are continuing to emerge, seemingly at a faster rate than before, and many are capable of spreading rapidly, causing severe disease and high fatality.

If we are to keep one step ahead of the epidemic curve we need to add new instruments to the toolbox – not just tools to prevent and cure diseases, such as vaccines and antibiotics, but tools that help us understand how pathogens emerge, evolve and spread.

We need to gain rapid insight into the forces that drive the emergence and spread of microbes if we are to predict when, where, and in what form, new pathogens will emerge, and guide national and global efforts to control them.

As most of the emerging pathogens, including Ebola, cross over from animals to humans, this adds a new layer of complexity that needs to be understood before effective and durable control measures can be put in place.

Scientists around the world are using the recent explosion of information on the genes that make up viruses and bacteria in order to understand how they evolve and spread.

New Zealand scientists at the Allan Wilson Centre have been at the forefront of developing models and software that take this genetic information and use it to determine patterns of evolution.

Using these tools we can now gain unique insight into how pathogens move around the globe, when and where they cross over from animals to people, and help decide what are the most effect measures to control them.

These recent advances have been used to understand and control "headline" diseases such as Ebola and influenza as well as others that, despite causing considerable suffering, go seemingly unnoticed.

One example is the emergence of new strains of salmonella in sub-Saharan Africa that have received relatively little attention, despite causing severe invasive disease and high mortality in many countries.

The steady evolution and acquisition of resistance to multiple antibiotics in these strains is of considerable concern, and may hamper efforts to control infection, particularly in low-resource countries.

Between 2000 and 2009 New Zealand experienced an epidemic of a strain of salmonella that appeared to originate in wild birds around Christchurch.

Many may remember the large number of wild bird deaths in species such as sparrows and silvereyes around the year 2000, but few may be aware that the same strain caused over 2500 human cases of gastroenteritis in New Zealand over the following decade.

New studies of this strain of salmonella, using archived material, indicate an explosive epidemic in wild birds, just prior to 2000, that resulted in a rapid expansion of the salmonella population and consequently a large spike in human cases over the subsequent year.

Such information is valuable for determining how the source of an epidemic changes over time, where to target control measures and how to deal with future epidemics.

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By developing and applying new tools, scientists in the centre are now turning their attention to combating food and waterborne diseases, such as those caused by campylobacter, E. coli, cryptosporidium and giardia.

These are important diseases globally, but also highly prevalent in New Zealand, causing considerable suffering and economic losses. Working on national and local scales, in collaboration with scientists at the Institute of Environmental Science and Research, new studies are helping to determine the environmental and human health impacts of how we manage ecosystems and produce food.

As an example of a local-scale project, Allan Wilson Centre scientists are working with Te Aitanga a Hauiti at Uawa/Tolaga Bay to examine the health of water and natural food supplies, providing valuable information for decision making in the community.

We are in an evolutionary arms race with the emergence of new pathogens, and need to find better ways of controlling existing diseases.

By advancing knowledge in key areas, New Zealand scientists continue to making significant contributions to the global effort to reduce the suffering caused by infectious disease.

Professor Nigel French is the principal investigator of the Allan Wilson Centre, the interim director of the new Food Safety Centre at Massey University, and a newly elected Fellow of the Royal Society of New Zealand