The year 2014 saw a plethora of world changing events; most notably the Ebola outbreak taking centre stage on the global health agenda. In this edition’s roundtable discussion, *International Innovation* asks featured researchers and leading healthcare experts their opinions on the successes of 2014 and the consequences for the future of their respective fields.

**Q:** Taking a look back over 2014, what do you consider the greatest achievements to have emanated from your field? What do you expect the major implications for your research to be in 2015 and beyond as a result?

**PROFESSOR CHARLES LIMOLI**
(University of California, Irvine, USA):

Much of our recent work defining the structural changes caused to neurons by radiation and chemotherapy have provided compelling mechanistic evidence for how these destructive agents damage the brain, impairing cognition. Research moving forward will have to account for these observations, and pharmacologic and stem cell based strategies will need to be developed further to protect host neuronal structure. Such efforts hold promise for preserving cognitive health and improving the quality of life of those subjected to ionising radiation and/or chemotherapy.

**DR PAUL BRAY**
(Thomas Jefferson University Hospital, USA):

In 2014, the advances in genomics, transcriptomics and proteomics have enabled discoveries about platelet physiology heretofore not possible.

From 2015 onwards, I expect our research to define more genes and gene variants responsible for inter-individual variation in platelet function and identify new antiplatelet agents that will benefit patients regardless of race or ethnicity.
The Ebola outbreak in 2014 has heightened people’s awareness of the importance of the immune system in protection from harmful microbes, and the continuing benefits of developing new vaccines and therapies. It is sometimes easy to become complacent about and forget the many advances that have been made in human health, as well as the numerous challenges that still remain.

Luckily for some, but regrettably not for all of those infected, there had been major investments made towards understanding Ebola pathogenesis and treatment since it was first discovered. The epidemic has reminded many that in our ever-changing world there are still threats to be overcome and that efforts today can make a world of difference in the future. There is clearly a need to keep thinking about and supporting the development of effective treatments not only against Ebola, but for many other infectious and non-infectious diseases. I hope that the outcome with respect to our research will be a wider realisation that there are still many aspects of the immune system and its role in protecting human health that are yet to be discovered. Increased funding for immunology and medical research is a great investment!

The benefits of intravenous tissue plasminogen activator (tPA) in patients with acute ischaemic stroke are time-dependent, and guidelines recommend a door-to-needle (DTN) time of 60 minutes or less. However, studies have found that less than 30 per cent of US patients are treated within this window. Evidence also suggests disparities in timely treatment in patients who are older, African-American or female.

Target: Stroke – an initiative launched by the American Heart Association/American Stroke Association (AHA/ASA) in early 2010 as an extension of the Get With The Guidelines®-Stroke programme – is focused on improving acute ischaemic stroke care by reducing DTN times for eligible patients being treated with tPA. A recent study on Target: Stroke (Fonarow et al., *Journal of the American Medical Association*, 2014, 311, 1632-1640) indicated the positive impacts of the initiative: 1) participating hospitals dropped average DTN times from 74 to 59 minutes – a 15 minute improvement; 2) overall, the percentage of patients treated within 60 minutes increased from less than 30 per cent to more than 50 per cent; and 3) patients treated within 60 minutes experienced improved outcomes, including lower in-hospital mortality and reduced long-term disability.

Now AHA/ASA is launching Target: Stroke Phase II to continue eliminating treatment delays for people who suffer ischaemic strokes. The primary goal for Target: Stroke Phase II is for hospitals to achieve DTN times within 75 per cent or more of acute ischaemic stroke patients treated with tPA.

2014 saw a revival of interest in the importance of macrophage migration inhibitory factor (MIF) and CD74 as key pathogenic factors in multiple sclerosis and a number of other neurodegenerative diseases and conditions. Our research is focused on mechanisms involved in the MIF/CD74 axis and provides a potent natural biologic construct as a possible therapy for these otherwise nearly untreatable conditions.

The Ebola outbreak represents a turning point in the history of infectious diseases. After an effective vaccine becomes available, we will never again see this virus causing a public health disaster. A vast treasury of infectious disease knowledge has been discovered in the last 150 years. In the future, the diseases that have ravaged mankind for thousands of years will be prevented. The World Health Organization (WHO) has announced: “Some diseases are close to being eliminated or eradicated completely, among them poliomyelitis, leprosy, neonatal tetanus, guinea-worm infection and Chagas disease”. After national vaccine programmes in the US, the annual cases dropped to zero or close to that for smallpox, diphtheria, measles, polio, rubella and *Haemophilus influenzae* type b. To me, it is an exciting time to participate in public health without borders.
has been an appreciation for the importance of manipulating the gut microbiome and the implications of subsequent alterations in the gut mucosal immune system on bone metabolism and health. Understanding the role of gut mucosal immunity in osteoporosis, as well as other chronic diseases, is likely to have far reaching implications.

Our work has the potential to provide new insights into the effects of phenolic-rich foods on novel aspects of the immune system, which could provide new low cost strategies for preventing, and perhaps even treating, osteoporosis.

PROFESSOR STEPHEN BYERS
(Georgetown University, USA):

The rise of cloud-based computing and the resulting ability of individuals, small research groups and start-ups to carry out ‘high performance computing’ as well as big data analytics at manageable cost is set to level the playing field and dramatically stimulate innovation in many fields. In the drug discovery and personalised medicine arenas, we are on the brink of an era in which high fidelity molecular profiling can be linked to individualised drug treatment regimens. To facilitate this approach, the advances in computation, drug screening and drug repurposing need to be better linked to electronic health records in a manner that protects patient privacy. Discussions among third party payers (the insurance industry), drug producers (the pharmaceutical industry) and intellectual property experts should be aligned to focus on modifying patent law to more clearly reflect the new reality that most innovation in these areas is a result of input from many partners. We need to move away from the ‘prisoners dilemma’ approach to invention and recognise cooperation, sharing the benefits of the group as a whole.

DR MUNEESH TEWARI
(University of Michigan, USA):

One of the very interesting advances in the biomarker field has been the demonstration that simple devices, such as those that can be plugged into a smartphone, can be used to carry out diagnostic tests [eg. for infectious diseases] at the point of care in clinical settings. By bringing the clinical lab to the patient, I believe this opens up great possibilities for transforming the scale at which translational research data can be connected, as well as for moving healthcare increasingly out of the hospital and into the home. That would be very beneficial for solving some of the problems facing healthcare systems worldwide.

PROFESSOR BRENDA SMITH
(Oklahoma State University, USA):

Perhaps the most significant advance in the field of bone and mineral research over the past year has been an appreciation for the importance of manipulating the gut microbiome and the implications of subsequent alterations in the gut mucosal immune system on bone metabolism and health. Understanding the role of gut mucosal immunity in osteoporosis, as well as other chronic diseases, is likely to have far reaching implications.

Our work has the potential to provide new insights into the effects of phenolic-rich foods on novel aspects of the immune system, which could provide new low cost strategies for preventing, and perhaps even treating, osteoporosis.

DR JANET WOODCOCK (US Food and Drug Administration, Center for Drug Evaluation and Research, USA):

We are just at the very beginning of a revolution in therapeutics. There is a movement towards a molecular-based understanding of disease and intervention based on that knowledge. That means moving away from what we have done in the past with empirical, hypothesis-based testing. This process is going to take a while, probably 20 years, but eventually it will lead to a very high success rate for drugs because we will be able to successfully predict their effects in people before human trials. There are promising signs towards that goal, which will result in highly effective therapies that are very personalised, and much safer than they are now.

DR HAO WU (Boston Children’s Hospital and Harvard Medical School, USA):

The single most significant achievement in immunology in the past couple of years has been cancer immunotherapy targeting specific molecules that inhibit the immune system. Targeted strategy emanating from our studies will be a future prospect for specific therapy.