

## Presenting the marvels of immunity

Daniel M. Davis

The immune system is one of the most intensely studied of all human systems. Hundreds of thousands of scientists have spent their days (and lives) trying to understand just one part of it. Yet this vast human endeavour remains largely unknown to the general public. Our community could do more to present immunology as the great and important scientific adventure that it is.

There are at least four major reasons why understanding the immune system is worthy of widespread attention. First, because our knowledge of the immune system is crucial for understanding human health and disease. New ideas for medicine in the twenty-first century build directly on our understanding of immunology — from the development of new antibody-based cancer drugs to advancing treatments for immune-mediated diseases, such as autoimmunity and allergies. The next generation of scientists and physicians must be inspired to tackle the vast array of unmet medical needs, and the application of old ideas — the take-up rates of vaccines, for example — can benefit hugely from public discussion of immunology.

Second, because, as well as the *raison d'être* of the immune system being to seek out and destroy dangerous bacteria, viruses, fungi and such like, its activity connects with other body systems and influences, for example, our metabolism and hormone levels, and controls how well we feel. Sleep, stress, nutrition and our mental health are all connected to our ability to fight infections. Even though this is perhaps on the periphery of many immunology meetings, the public are fascinated by the connections between lifestyle choices and immunity because there may be practical implications for what it takes to be healthy. There are many gaps in our knowledge here, and discussion with the public can have an impact on research priorities.

Third, for the wonder of it all. If solace or joy can ever be gleaned from the beauty of nature then the way our immune system works is as inspirational as any other frontier of science, from the birth of stars to the substructure of atoms. The human body is one of the greatest wonders of the universe, and its complexity, delicacy and elegance is clearly revealed in the way our immune system works. As Carl Sagan put it, “*Not* explaining science seems to me perverse. When you’re in love, you want to tell the world”<sup>1</sup>.

And the fourth reason for promoting general interest in immunology is that the quest to understand this part of us is one of mankind’s greatest scientific adventures.

Behind the impersonal knowledge laid out in the pages of this journal and in immunology textbooks, lies a saga of individual hardships, triumphs and sacrifices. And from this history — a story of how ideas develop — our own struggles and successes gain context.

There are, in addition, many specific messages from immunology that deserve to be widely known. The immune system is a wonderful basis for a discussion of human diversity. The genes that vary the most between individual people are not those that influence physical characteristics — such as skin, eye or hair colour, for example — but are the genes of the immune system<sup>2</sup>. The way our species has evolved to survive the constant onslaught of infectious disease requires the genes of our immune system to be exceptionally diverse. No other area of science demonstrates more clearly the fundamental importance of our differences.

Immunology is also a story of enormous international cooperation. Progress has rarely been made by a ‘eureka’ moment for one individual and, more commonly, discoveries from many scientists across the globe, when put together, open up new ideas about how our species fights disease. Any modern immunology conference testifies to this and historically, our community has led the way in international cooperation. The organization of the HLA system in the 1960s, for example, was probably the first scientific success arising from the gathering of a major international consortium — a forerunner to the better known modern international collaborations in particle physics and the Human Genome Project<sup>2</sup>.

So, immunology must be of general interest and the next question is who should tell the story, and how? A potential problem is that immunology is a vast subject with terminology that takes some getting used to. Ideas build upon each other, so there is a slope in understanding the details — something that mainstream television documentaries tend to shy away from, as only a very shallow slope in difficulty is usually allowed on television. Blogs, social media and public lectures can be useful entry points into immunology, however they

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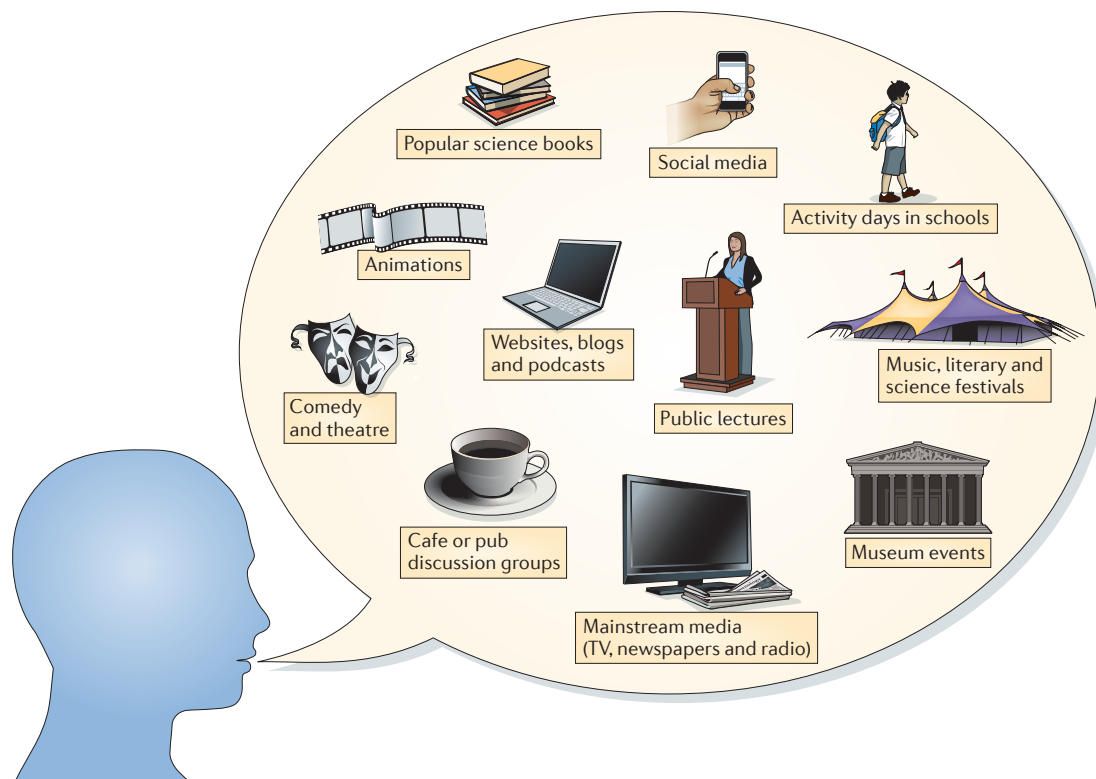


Figure 1 | **Engaging the public with immunology.** An illustration of the many ways in which we can discuss immunology with the public.

perhaps tend to attract people who have some interest in the subject already, such as researchers and students. To reach as wide an audience as possible, many individuals and organizations have taken innovative steps forwards, including presenting at music festivals, holding open days, building computer games, organizing late-night museum events, comedy and theatre shows and taking activities into schools. The past few years have seen a huge swell in the number of ways in which scientists have sought to discuss their work with the public (FIG. 1).

Perhaps books remain, at least for the moment, a good format for presenting the subject in depth. We have all been inspired by many well-known charismatic science writers and presenters over the years: Carl Sagan, Neil deGrasse Tyson, Brian Greene and Brian Cox on the cosmos; Stephen Jay Gould, E.O. Wilson and Richard Dawkins on evolution; Steven Pinker and Noam Chomsky on language; Oliver Sachs on neurology — and I could namecheck countless others — but there is relatively little out there on immunology.

Peter Medawar is our historical role model here; his legacy — born from his Nobel prize-winning experiments on acquired immunological tolerance<sup>3</sup> — was undoubtedly cemented by his wonderful writing, radio broadcasts and public lectures. As Dawkins has written, Medawar “is surely the wittiest of all scientific writers” (REF. 4). Medawar’s books are still read today — perhaps most commonly his *Advice to a Young Scientist*, which was published in 1980 (REF. 5). Peter Doherty — another Nobel laureate who, during an intense two-and-a-half years of work with Rolf Zinkernagel,

discovered the role of MHC genes in immune defence against viruses<sup>6</sup> — has similarly presented advice in *The Beginners Guide to Winning the Nobel Prize*<sup>7</sup>. He knows that “science is about telling good, readable, memorable stories” (REF. 7).

The immune system features in several other books, such as the Pulitzer Prize-winning *The Emperor of all Maladies: a Biography of Cancer* by Indian-born physician Siddhartha Mukherjee<sup>8</sup> and Robert Weinberg’s *One Renegade Cell*<sup>9</sup> — both about cancer — as well as Stephen Hall’s *Commotion in the Blood: Life, Death, and the Immune System*<sup>10</sup>, which is about early attempts at immunotherapy; and these books are an inspiration to many. There are also plenty of academic books on the history of transplantation or vaccine development, for example, but broadly speaking, the bulk of our knowledge about the immune system remains largely inaccessible to the public.

By attending any immunology conference or reading any of our journals, it is clear that plenty of us have the necessary skills in oratory and writing to change this. A critical view of science and medicine from professional journalists is important<sup>11</sup>; Ben Goldacre’s advocacy for improving access to clinical trial data comes to mind<sup>12</sup>. But, as well as the precision we can offer as experts, only we can give an insider’s perspective<sup>13</sup>.

It is not for everyone and the research itself is paramount, yet surely more could be done to encourage immunologists to present the subject widely. Leaders of universities, research institutes and companies must take science communication seriously and give researchers

the time and freedom for public engagements — it is part of their social responsibility. From the bottom up, we must acknowledge that outreach is important and that it is often the best researchers who are good at explaining a subject. Finally, the right time for us to engage with the public is now. Readers of popular science and those who have watched the television documentaries are by now *au fait* with the basics of DNA and evolution — they are ready for new concepts.

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#### Competing interests statement

The authors declare no competing interests.

#### FURTHER INFORMATION

Bite-sized Immunology: <http://bitesizedimmunology.org/>

British Society of Immunology at the Green Man Festival:

<https://bsi.immunology.org/public-engagement/--bsi-einsteins-garden>

Cheltenham Science Festival: <http://www.cheltenhamfestivals.com/science>

Conversations on science from The Edge: <http://edge.org/conversations>

Day of Immunology: <http://www.dayofimmunology.org.au/Home/>

Edinburgh Science Festival: <http://www.sciencefestival.co.uk/>

Immune Attack: the computer game: <http://immuneattack.org/>

Immunology blogs from Stanford University: <http://scopeblog.stanford.edu/category/immunology/>

Immunology Explained: <http://www.immunologyexplained.co.uk/>

Meet your microbes, a TEDMED talk: [http://www.ted.com/talks/jonathan\\_eisen\\_meet\\_your\\_microbes](http://www.ted.com/talks/jonathan_eisen_meet_your_microbes)

Podcast of The Infinite Monkey Cage: <http://www.bbc.co.uk/podcasts/series/timc>

The Compatibility Gene, a TEDx Youth talk: [http://www.youtube.com/watch?v=gduFeM\\_lvVM](http://www.youtube.com/watch?v=gduFeM_lvVM)

The Cosmic Genome app: <http://cosmicgenome.com/about/>

The History of Vaccines: <http://www.historyofvaccines.org/>

The Science Showoff: <http://scienceshowoff.wordpress.com/>

The World Science Festival (New York): <http://www.worldsciencefestival.com/>

The Worm Wagon: <http://www.mig.lis.manchester.ac.uk/impact/>

Tim Dowling's humorous piece on immune system genes: <http://www.theguardian.com/lifeandstyle/2013/sep/08/can-you-smell-perfect-partner>

Wellcome Trust computer games: <http://www.wellcome.ac.uk/Funding/Public-engagement/Funded-projects/Major-initiatives/Broadcast-media-strategy/Gamify-Your-PhD/WTDV033976.htm>

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## **Author biography**

Daniel M. Davis obtained a Ph.D. in Physics before doing postdoctoral research with Jack Strominger at Harvard University, USA. Davis is currently a professor of immunology at the University of Manchester, UK, and a visiting professor at Imperial College, London, UK. He has published over 100 academic articles and was elected a Fellow of the Academy of Medical Sciences, UK, in 2011. In 2013, he published *The Compatibility Gene*, a popular-level book about the HLA system, which was picked by Bill Bryson in the Guardian's Books of the Year.

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## **Web summary**

To coincide with the 'Day of Immunology', Professor Daniel Davis issues a 'call to arms' to immunologists, explaining the importance of engaging the public with the field of immunology.

## **Subject categories**

Biological sciences / Immunology [URI /631/250]

Scientific community and society / Scientific community / Education [URI /706/648/160]