



A NEW OPTION SET FOR LIFE
ANDREW F. READ

Born in 1962 in New Zealand (source of charming accent); B.Sc. (Hons) Zoology, Otago University (1984); Commonwealth Scholar, Oxford University, D.Phil. Evolutionary Biology (1989); Junior Research Fellow, Christ Church, Oxford (1988–1992); Adjunct Professor in Evolutionary Ecology, Tromsø University, Norway (1992–1997); BBSCR Advanced Research Fellowship, University of Edinburgh (1993–1998); Professor of Natural History, University of Edinburgh (1998–2007); Professor of Biology and Entomology, and Eberly College of Science Distinguished Senior Scholar, Pennsylvania State University (2007–current). I attempt to exploit modern notions of adaptive evolution to attack biomedically and theoretically challenging phenomena like pathogen virulence, infectiousness, vaccine escape and drug and insecticide resistance. My research group mostly works on malaria, but we have also toyed with worms that parasitise humans, fungi that kill insects, bacteria that sterilise waterfleas and viruses that cause cancer in chickens. – Address: Center for Infectious Disease Dynamics, Departments of Biology and Entomology, 208 Mueller, Pennsylvania State University, University Park PA 16802, USA.

I write this at 35,000 feet over the Atlantic, another trip to create a new life in the New World. I began the year at Wiko as Professor of Natural History at Edinburgh University and ended it as Professor of Biology and Entomology at Penn State. Much of my Wiko year involved creating and then eliminating an option set for a new job. Edinburgh had been good to me, but I was going stale. My wife's optimism that going to Wiko would put things right was oh so wrong. Wiko showed me an intellectual world – in biology and more importantly out of science – that convinced both of us that I needed out of my rut.

The new path will surely in time turn into a rut too, but I hope now to see the signs earlier and to retreat to Wiko-world in time. When I arrived in Berlin, the endless grind of raising money, re-writing student manuscripts, interviewing, refereeing, health and safety paperwork, human resources paperwork, animal experimentation paperwork, exam board paperwork, space wars, interpersonal problems in the lab, broken equipment, mentoring emotionally stressed career development fellows, departmental politics ... well, I was beginning to blame biological research and wondering about getting out. But by the end of our Wiko year, I had all my graduate student enthusiasm back, and in spades. I now feel high voltage flowing through me and, once again, I feel sorry for people who don't get paid to think about evolution and infectious disease.

I was proud of what I did not do in Berlin. I used Wiko to turn down "invitations": 15 to talk, 25 to referee papers, and one to join an editorial board. I also abandoned a book (on vivisection) and a planned review (tentatively called "Red Queen or Red Herring?"). Still, life intruded. Four talks, 35 letters of reference, 3 evaluation letters, 14 papers refereed, 3 prize committees, 2 scientific advisory boards, 3 grant proposals written (one successful, \$US 10 mill, declined; one part-funded (£100K); one rejected, now resubmitted, decision pending).

But I also find myself surprisingly proud of what I did do. It was my most productive year in terms of both quantity and quality of papers – all achieved while working fewer hours than I have for years, and getting a new job, and having a great time with my family and colleagues. It was, as always, hugely satisfying to see projects I had led for years coming to fruition. But the quality of the science I achieved surprised me most. The ability to concentrate on one thing for an extended period of time (e.g. a whole morning) makes it possible to do way better science. And a most peculiar thing happened. I now have several yet-to-be-written papers burning in my head. Much to my surprise, my current answer to the question, "What would you do if told you have only six months to live?" is: get those damned papers finished. Previous answers to that question have never involved science.

Mostly, I cleared the backlog of papers that my research group and collaborators needed to finish, but some magic extra stuff came up during that process (Day et al. 2007, Råberg et al. 2007, Wargo et al. 2007). Time will tell what wider impact those papers make, but they made a big impact on me: working on great problems with class people in an environment that empowers thinking. My biggest intellectual struggles were with a book chapter I thought would take a week to write (Read and Mackinnon 2008). In the end the beast took four months to slay, and I can't help feeling it was a slightly ugly slaying that might

not yet be over. But I resisted the temptation to write the book the topic deserves: scientists don't read books, and besides, just the chapter hurt a lot. In it, we asked why vaccines keep working despite pathogen evolution, whereas antibiotics routinely fail because of it. I now think that the answer means that newer generations of vaccines will fail – and may in some cases create superbugs. Today's vaccine developers are as complacent about evolution as were drug developers in the years before evolution began systematically rendering useless the world's antibiotics.

Oddly, lunch with a photographer changed the way I think about what I do. Tomasz Kizny made me realise the annual on-going, year-in, year-out malaria body count is comparable to the worst spasms of human brutality, and I began to wonder why we – rightly – worry so much about genocide and yet – wrongly – seem quite content to let a completely preventable disease like malaria rampage. It kills the equivalent of a 9/11 every day, a Dresden firebombing every two weeks, a Rwanda every year, a Holocaust every few years. Unlike genocide, malaria will never burn itself out. Do we do so little about it because it is “natural”? Prevention is easy: concrete houses, mesh screens on windows, bed nets, environmental modification, primary health care – but these are apparently too expensive for politicians. So while scientists are making careers trying to find politicians cheaper solutions, the people go on dying. A “War on Malaria” would be easier and cheaper than the “War on Terror” – and done properly might go a long way to making a War on Terror unnecessary. Malaria doesn't need science, it needs money, and as the Iraq war has shown, money follows political will.

Wiko's lunches, dinners, colloquia and German lessons left me a kaleidoscope of other thoughts. I learnt that a painting of a bowl of fruit can be shocking. That evolution and global climate change really are a threat to Christianity, but the biggest threat to organised religion is not what science is discovering but good theology. That we are what we give as gifts. That in South Africa, religion played an unusually negligible role in generating conflict: the Bible both justifies and abhors apartheid. That the mathematical precision of German grammar is actually beautiful. That the most explosive success of biology is that it has solved the problem of evil. That a way to figure out why somebody starts something is to ask why they stop it. That constitutions are a civilising achievement but getting them right is not straightforward. That Baghdad is being torn apart because people disagree about who was the nephew of Mohamed. That the notion of free will could be a social construct to aid the fight against our deepest urges to steal food and other peoples' partners. That

one hour of questions is needed after colloquia because brevity is not a quality much admired in the humanities.

And Berlin, oh Berlin. I don't much like cities – they've always seemed the cost to pay for working in universities – but Berlin is so special. The space, the people, the melting pot. The trees, the concrete, the water. And history so in your face you question history itself. Everywhere you see how regimes across the political spectrum have tried to direct society by using historic sites to shape perceptions of the past. British historical sites are sterile theme parks; Berlin's continue to mould Germany. A rich, broke city, with deep wounds healing fast with terrible scar tissue. In less than a day, I saw my first opera (Salome) and my first concentration camp (Sachsenhausen), a juxtaposition of the best and worst of Germany so draining that I had to turn away unexpected guests and seek solitude. I went to the Gedenkstätte Berlin-Hohenschönhausen with the kids and a friend, and then went back with my wife and sister. Everyone should visit Hohenschönhausen. On my first trip, Tony Blair was trying to extend the period terrorist suspects could be held without charge from one month to three. His initiative was killed off because there was no evidence it would make a difference. He was trying again on my second trip. There still is no evidence that more time will convict more terrorists, but nonetheless, the new British Prime Minister is giving it a third shot. In Hohenschönhausen, the only thing the Stasi had was time.

It is too early to say what the long-term consequences of my Wiko year will be. I am not sure what I make of the fact that we biologists at Wiko worked so hard writing stuff that none of us will ever have time to read. I also can not help but feel that so much of the research enterprise gets in the way of research, taking away the time to be brave, to be lateral. I feel a growing disquiet with where conventional biology is going. It increasingly deals with jobs, careers, readily soluble science, often carried out with little deep thought. It is ever more reductionist, even though there is little evidence that real world problems – and indeed interesting problems – can be solved that way. You do not address traffic congestion by figuring out how the car works, least of all at the molecular level. Our year at Wiko had an outstanding collection of biologists, all at the top of their game, all avoiding those traps. Many of us went to a scientifically excellent meeting in the Austrian Alps at the end of the winter, and we all felt somehow different from the others there. And we were. The damned humanities environment at Wiko had made us happy to discuss and think about *anything*. Biology is fascinating – but I now realise that many biologists are not. There was only one Wiko colloquium I found about as valuable as watching daytime TV. In a good year, about a quarter of the biology seminars I go to are like that. I now fear that

frequency will rise for the rest of my life. And I feel a disquieting urge to seek out colloquia as broad-minded and wide-ranging as those at Wiko.

During the whole year at Wiko, I got only two e-mails from Wiko staff asking me to do something. One asked for the name of the Edinburgh administrator who had failed to invoice Wiko for money owed; the other was the request to write this article – as Dieter Grimm said, the only obligation of the year. Over the years, others in their reports have, more eloquently than I can achieve, sung the praises of the staff who create this perfect Wiko-world (and who are too numerous to name here). Along with our predecessors, my family and I are deeply grateful for the food, the support, the environment, the laughs and the enabling, as well as the insights into Wiko, Berlin and German. And to my fellow Fellows, and their spouses and families: I have never had so much fun and intellectual stimulation simultaneously – ever. Thank you. For a year, the world was as it should be. And it won't be the same again.

Papers completed

Barclay, V. C., L. Råberg, B. H. K. Chan, S. Brown, D. Gray, and A. F. Read (in press).

“CD4⁺ T cells do not mediate within-host competition between genetically diverse malaria parasites.” *Proceedings of the Royal Society of London Series B*.

Day, T., A. L. Graham, and A. F. Read (2007). “Evolution of parasite virulence when host responses cause disease.” *Proceedings of the Royal Society of London Series B* 274: 2685–2692.

Grech, K., B. H. K. Chan, and A. F. Read (in press). “The impact of immunisation on competition within *Plasmodium* infections.” *Evolution*.

Grech, K., L. A. Maung, and A. F. Read (2007). “The effect of parental rearing conditions on offspring life history in *Anopheles stephensi*.” *Malaria Journal* 6: 130–137.

Long, G. H., B. H. K. Chan, J. E. Allen, A. F. Read, and A. L. Graham (in press). “Anti-disease therapies: reducing disease severity but increasing parasite transmission?” *International Journal for Parasitology*.

Long, G. H. and A. F. Read (2007). “The expanding field of evolutionary immunology: ‘The impact of the environment on innate immunity: at the defence frontier – the biology of innate immunity’.” *Expert Reviews in Clinical Immunology* 3: 459–461.

Lynch, P. A., U. Grimm, and A. F. Read (in press). “How will public and animal health interventions drive life history evolution in parasitic nematodes?” *Parasitology*.

- Mackinnon, M. J., S. Gandon, and A. F. Read (in press). "Virulence evolution in response to vaccination: the case of malaria." *Vaccine*.
- Råberg, L., D. Sim, and A. F. Read (2007). "Disentangling genetic variation for resistance and tolerance to infectious diseases in animals." *Science* 318: 812–814.
- Read, A. F. and M. J. Mackinnon (2008). "Pathogen evolution in a vaccinated world." In *Evolution in Health and Disease*, edited by S. C. Stearns and J. Koella, 139–152. 2nd ed. Oxford University Press.
- Read, A. F. (2007). "The evolution of virulence: malaria, a case study." In *Evolutionary Medicine*, edited by R. Nesse. Henry Stewart Talks, www.hstalks.com, London (CD-ROM).
- Thomas, M. B. and A. F. Read (2007). "Can fungal biopesticides control malaria?" *Nature Microbiology Reviews* 5: 377–383.
- Wargo, A. R., J. C. de Roode, S. Huijben, D. R. Drew, and A. F. Read (2007). "Transmission stage investment of malaria parasites in response to in-host competition." *Proceedings of the Royal Society of London Series B* 274: 2759–2768.
- Wargo, A. R., S. Huijben, J. C. de Roode, J. Shepard, and A. F. Read (2007). "Competitive release and facilitation of drug resistant parasites following therapeutic chemotherapy in a rodent malaria model." *Proceedings of the National Academy of Science USA* 104: 19914–19919.