



ONE CULTURE
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Ricardo B. R. Azevedo was born in 1970 in Lisbon, Portugal. He received a Licenciatura in Biology from the University of Lisbon in 1992, and a Ph.D. in Evolutionary Biology from the University of Edinburgh in 1997. Some of his doctoral research was carried out at University College London. He conducted post-doctoral research at Imperial College London and Syngenta in the United Kingdom and at Albert Einstein College of Medicine in New York, before taking a faculty position at the University of Houston in 2003. He has used experimental, computational, and theoretical approaches to address questions on, among other topics, the evolution of sexual reproduction, the evolution of mutation rate, and the evolutionary causes and consequences of interactions between genes. – Address: Department of Biology and Biochemistry, University of Houston, 4800 Calhoun Road, Houston, TX 77204–5001, USA. E-mail: razevedo@uh.edu

Remembering the hundred or so days I spent at the Wiko this year puts me in mind of a short poem by Álvaro de Campos, the futurist heteronym of Fernando Pessoa. In the original Portuguese it reads:

O binómio de Newton é tão belo como a Vénus de Milo.

O que há é pouca gente para dar por isso.

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(O vento lá fora.)

Here is a rough translation:

Newton's binomium is as beautiful as the Venus de Milo.

The problem is that precious few people notice.

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(The wind outside.)

I love this poem because of the “one culture” sentiment that pervades it.

I, a biologist, believe that the strained communication between the “two cultures” of science and the humanities – the “wind outside” the Institute? – is an enduring problem for our intellectual life. But, despite having spent most of my working life at large universities with plenty of scholars in the humanities, I confess that only rarely had I gone out of my way to communicate across the divide. (My idea of interdisciplinarity was to talk to the odd physicist ...) My time at the Wiko has changed that.

I came to the Institute as part of a group assembled by Mark Viney to work on the evolution of phenotypic plasticity. Phenotypic plasticity is the phenomenon of an organism exhibiting different phenotypes when exposed to different environments. For example, most animals grow to a larger size when they develop at cold temperatures. I worked in this area in the mid-1990s, during my Ph.D. More recently, I have worked on a related topic: the evolution of robustness. My views on phenotypic plasticity have changed as a result of my stay at the Wiko for two reasons. First, because I finally read C. H. Waddington's 1957 masterpiece *The Strategy of the Genes*. This book, decades ahead of its time in outlining a synthesis of cell, developmental, and evolutionary biology around the concepts of phenotypic plasticity and robustness, helped clarify my thinking on these concepts. Second, my working group contemporaries – mainly Mark, Thomas Flatt, and Christian Braendle – were brilliant and stimulated my thinking constantly. I am hopeful that our discussions will soon result in new projects.

As I encountered the novel environment of the Wiko, my work underwent a certain plasticity of its own (whether adaptive or not remains to be seen). The Institute's phenomenal library made me borrow more books in a few months than I had in several years. I read my way to new directions. Perhaps the most salient of these was my adoption of Bayesian statistics. This is an approach to statistics that dispenses with the infamous “*P*-value”, and introduces a rigorous framework to measure the probability that different hypotheses are true given the available data. Bayesian statistics were especially appropriate to analyze the data from a mutation accumulation experiment conducted by some

colleagues of mine. The experiment used a ciliate, a peculiar unicellular creature that, as long as it reproduces asexually, can accumulate mutations in a nucleus that is never exposed to natural selection. This allows us an “unfiltered” look at the consequences of mutations for the fitness of these organisms. We submitted a manuscript on this work to the journal *Genetics* shortly after I returned from the Wiko.

Other readings were suggested by an interdisciplinary project with one of those physicists I alluded to above. They took me into the curious world of phase transitions – the familiar changes that water undergoes from gas to liquid to solid in response to changes in temperature are examples of phase transitions. (I’m embarrassed to admit that I had missed the obvious parallel between phenotypic plasticity and phase transitions until I wrote the previous sentence!) I have been working for a while on the evolutionary consequences of the exchange of genetic material between organisms, commonly known as sex. When I showed the data from some simulations of evolution under different amounts of sex to my colleague he told me that they had something of the phase transition about them. In a narrower manifestation of the “two cultures” phenomenon I did not take his remarks all that seriously at first: physicists see phase transitions everywhere! The more I thought about it, however, the more sense the connection made. Many phase transitions involve change from regimes where local processes dominate the behavior of the system to regimes where system-wide interactions take over. This could very well be the most unexciting way to think about sex in *either* culture ever, but I believe it could tell us something profound about evolution.

My time at the Institute has changed my perspective on the relationship between the two cultures, even though I didn’t leave with immediate plans to collaborate with any of the exceptional Fellows in the humanities. For example, I have a better understanding of both the similarities and the differences in our approaches to asking and answering questions about the world. I have certainly become more sensitive to scientists’ use of metaphors and language. I may also have grasped the concept of “normativity” at one point.

My time at the Wiko was highly stimulating in many other ways. Interacting with many of the Fellows was immensely rewarding. Discovering Berlin was a treat. Trying to learn German under the kind and patient guidance of Ursula Kohler was one of the most challenging things I have done as an adult, but also a lot of fun; I wish I had progressed further. One of the very first conversations I had at the Institute with people I had never met before was about Wagner’s music (one of my passions), and the topic “leitmotived” its way back into conversations throughout my stay with several Fellows, from all kinds of

backgrounds. It was marvelous to be able to attend excellent productions of four of Wagner's operas only a short distance from the Wiko. (I was also able to stump the library for a couple of days when I asked for an English translation of the libretto of *Rienzi* ...) Along with music, food, and drink, football (the Euro 2012) provided another potent catalyst for interdisciplinarity.

In conclusion, I am truly grateful to the Wiko for providing me with an ideal environment to experience real interdisciplinarity and with the opportunity to meet so many wonderful people. The entire staff, in all my interactions with them, were extremely helpful and supportive and always made me feel at home. I would like to single out Reinhart Meyer-Kalkus and the front door, kitchen, and library staff for special praise, simply because I ended up interacting most often with them.