

Robert M. “Bob” May, Lord May of Oxford, O.M., who was the second recipient of the Ecological Society of America’s Robert H. MacArthur Award, passed away at the age of 84 in Oxford, U.K., on April 28, after a long illness. Most of us would be happy to have had one brilliant career. Bob had at least five. He established himself as a star of theoretical physics in his native Australia, but was drawn to ecology out of growing concern about the deteriorating state of the biosphere. He spent part of a sabbatical in 1971-72 at the Institute for Advanced Study in Princeton, and used the opportunity to become acquainted with the great ecologist Robert MacArthur, at Princeton University, whose eponymous prize he won in 1984.

After a brief return to Australia, May was hired at Princeton to be a colleague of MacArthur and others; but sadly, he in effect became MacArthur’s replacement after the latter’s untimely death. At Princeton, he swiftly rose to prominence as one of the world’s leading ecologists, winning the MacArthur Prize, and publishing his lecture in *Ecology* as *The Search for Patterns in the Balance of Nature: Advances and Retreats*. Bob stayed at Princeton until 1988; in that year, he left for Oxford for his third career, as a Royal Society Professor, and immediately assumed a role of prominence in the British ecological community, eventually becoming President of the British Ecological Society. In 1994 he gave the prestigious Josiah Willard Gibbs Lecture of the American Mathematical Society, and is the only person ever to give both the MacArthur Lecture and the Gibbs Lecture, the AMS’s most important lecture.

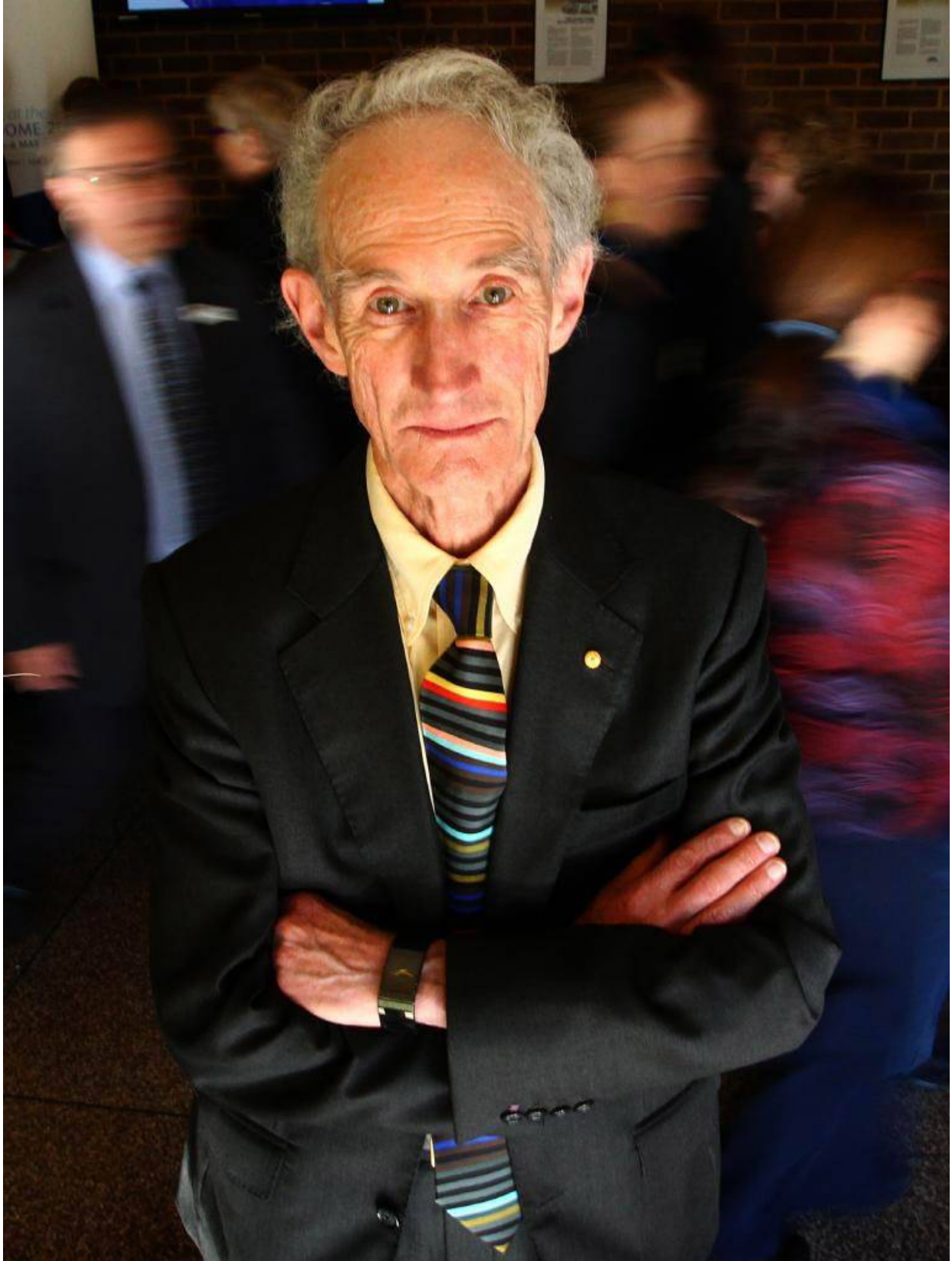
Having made his mark in two academic fields, Bob’s interest in how science influences policy was given full expression, and his fourth career began, when he was offered the post of Government Chief Scientific Advisor (GCSA) to the UK Government in 1995. His appointment came at a critical time for the relationship between the science community and policy making in the UK. The country had just emerged from the trauma of the bovine spongiform encephalopathy (BSE) crisis during which politicians had at times unwisely declared that the “science said” there was no risk to eating beef. The subsequent many deaths from variant Creutzfeldt–Jakob disease belied this assurance and raised questions of the complicity of science advice and policy makers, and a high-profile public enquiry exposed shortcomings in how the UK Government worked with its science advisors. Bob immediately grasped the importance of this issue and developed a series of guidelines that have since formed the rules of engagement between scientific advisors and policymakers. They stress the importance of advisors summarizing multiple viewpoints and being clear about uncertainty, and being open and transparent in what they tell policymakers. The May guidelines remain

highly influential and are part of the discussion about how scientific advisors and policy makers work together to address the covid-19 pandemic.

A second major theme of his tenure as GCSA was climate change as it coincided with key developments in this area and the agreements that led up to the Paris Climate Treaty. Bob had good relationships with both prime ministers he worked with (Tony Blair from the left-of-center Labour Party and John Major from the right-of-center Conservative Party) and was influential in avoiding the politicization of climate change in the UK that has hampered responses in a number of other countries.

Bob stepped down as GCSA and became president of the Royal Society, an office where he could again use his phenomenal ability to perceive and execute vital changes in management that led to significant changes in efficacy. Bob's thinking was always ahead of the curve and his insights helped sculpt British science and its role in shaping society. He received many honors from the UK: a knighthood and life peerage and — a special honor — a member of the Order of Merit.

In the time leading up to the financial crisis of 2008-9, Bob began his fifth career, turning his attention to lessons learned from his systems-oriented work in ecology to draw lessons for financial system stability. In 2008, about a half-year before the collapse of Lehman Brothers, Bob, with his former student George Sugihara and one of the authors of this note, wrote a paper for Nature Magazine, *Ecology for Bankers*, warning that the overconnectedness of the banking system and the emerging problems with subprime loans should cause regulators to fear for the robustness of the financial system. After the collapse of the system, he turned much of his energies to designs for better regulatory systems, working closely with Andrew Haldane, the chief economist of the Bank of England.



Robert M. May

Photo courtesy of Andy Dobson

*Jon: Can you add some parts here about Bob's career as a physicist, which comes out very well in your piece?*

May viewed his intellectual development from childhood and through his several careers as having been guided by extraordinary mentors, whom he met by being "extraordinarily lucky", most critically during his years at Sydney Boys High School (1948-52) and as an undergraduate at Sydney University (1953-56). Bob tells this story with passion in a 2011 interview with the science journalist Robyn Williams, which was recently rebroadcast on the *ABC Science Show*, and in a longer transcript of that interview on the web site of the Australian Academy of Science (<https://bit.ly/2WKz77N>).

In high school, the most influential of Bob's "uniformly excellent" teachers was Lenny Basser who taught chemistry "by not teaching us." Instead, he told stories about past students and challenged his students to find exam subjects that interested them and write essays on those subjects. Some students hated this approach, but Bob and many others loved it. Basser ended up producing eight future Fellows of the Royal Society, including a Nobel Prize winner and a president of the Royal Society (Bob).

May also participated actively in the school's outstanding debate team, which dominated its league during those years. Perhaps because of his skill in public argumentation, he was urged by many advisors (but not by Basser) to pursue a law degree when he went to university. He ended up choosing chemical engineering instead, but then discovered that he enjoyed and excelled at math and physics, even winning a substantial prize by topping an exam in the honors physics course. This led to a more advanced second-year physics course, and soon he came to the attention of Professor Harry Messel, who had recently assembled a small but world-class group of faculty in theoretical physics at Sydney (John Blatt, Stuart Butler, and Robbie Schafroth). Bob got to know this group through doing an honors year in physics as part of his chemical engineering degree. Seeing what fun they were having, he decided in the end to become a scientist rather than an engineer.

For his Ph.D., supervised by Schafroth, he began working on a model that the Sydney group had devised to explain superconductivity, and which turned out to be close but not identical to the correct explanation which was soon published by Bardeen, Cooper and Schrieffer. Bob finished his thesis on other aspects of the superconductivity problem and then did a postdoc with Max Krook at Harvard, where he met his future wife Judith Feiner, "the luckiest of all the lucky things in

my life." Bob returned to a faculty position in physics at Sydney, he and Judith married, and within a few years he was promoted to a named professorship.

He became concerned about environmental issues in the late 1960s, in part through the influence of a distinguished faculty colleague, the ecologist L.C. Birch. Both Birch, who won the ESA's Eminent Ecologist Award in 1988, and the brilliant physicist Freeman Dyson, who was at the Princeton Institute for Advanced Study when May visited on a sabbatical in 1971, had suggested that Bob talk with MacArthur about whether he should change fields and become a theoretical ecologist. In the end his second career went far beyond just changing fields. He played a leading role in the development of theory that now underpins modern ecology and provides humanity with indispensable tools to address 21st-century problems ranging from biodiversity loss to epidemic disease to climate change.

May's early work focused on understanding the relationship between the stability of ecosystems (collections of interacting species) and diversity of species. In a simple but elegant paper, he argued that the stability of an ecosystem as measured by the maintenance of an equilibrium should decrease as species diversity and system complexity increased. This flew in the face of conventional ecological wisdom that large, species-diverse ecosystems would be stable in terms of species abundances; and as Bob occasionally remarked, it made it challenging to understand why the world outside his window, or in the Institute Woods, continued to persist. The paper engendered many followers, and much debate, and continues to stimulate theoretical and applied work today.

Understanding the relationships between the various perspectives set a major agenda for ecologists over the next 30 to 40 years. Bob outlined his theory in his path-breaking book "Stability and Complexity in Model Ecosystems," an early volume of the series he co-edited for Princeton University Press. It is a book that can still be read productively today, full of insights, eloquence and a guide for thinking about natural history from a quantitative dynamic perspective. In an immensely influential paper, Bob also showed how chaotic behavior could arise deterministically in simple ecological models. He and the British scientist Roy Anderson then followed with a series of fundamental papers and a textbook that has become the bible for those working on the modeling of infectious diseases, extending his influence to another area and bringing it into the sphere of ecological research. Bob also was a regular contributor to Nature Magazine's News and Views for many years, encompassing a broad range of topics in ecology, epidemiology and conservation biology, and exhibiting biological depth and trenchant wit.

[Sydney/Harvard/Judith paragraph moved forward to end the Australia/physics section – but I couldn't find a place for the Clive James anecdote, sorry.]

May embraced life at Princeton with the zeal and gusto he brought to everything he did. He totally adopted ecology as his discipline, writing a series of keystone papers and editing the textbook “Theoretical Ecology” that laid out the many environmental problems that would benefit from a quantitative approach. He also took over the co-editorship with the late Henry S. Horn of the influential Princeton University Press “Monographs in Population Biology.”

May mentored everyone from undergrads, graduate students and postdocs to colleagues and members of the administration. He reveled in teaching and co-taught introductory biology, balancing the traditional chemistry, developmental and physiologically based syllabus with evolutionary-ecological theory. He relished working with empiricists, infusing their studies with theory that often shed new light on old problems.

He became chair of the University Research Board, where he was most proud of his successful argument to maintain a cap on the rate of overhead added to research grants. This ultimately saved Princeton many millions of research dollars when other less abstemious institutions fell afoul of new rules for research funding and had to repay a significant fraction of the excessive overhead they had accrued. He also took particular delight in the “Zero” parking sticker conferred on him for this position, which allowed him to park directly outside his office and next to the tennis courts for his early morning tennis games with fellow physicists and mathematicians Sam Treiman, Si Kochen and others naïve enough to underestimate Bob’s competitive nature. Parking his red BMW as close as possible to where he needed to be allowed Bob maximum time for the multiple tasks he undertook every day, from solving problems with an elegant fountain pen on yellow sheets of legal paper, through his continual dictation of a voluminous correspondence. Once he moved to Oxford, his racket indulgence expanded obsessively to include the archaic sport of “real tennis.”

In 1974, Bob was invited to visit Silwood Park in England by (later Sir) Richard Southwood, then chair of Imperial College’s Zoology & Applied Entomology Department. Silwood Park is Imperial’s country campus 30 miles outside London not far from Windsor. Southwood had recruited a series of young ecologists who with colleagues in other UK universities (York and Oxford in particular) were taking a much more quantitative approach to population ecology. Bob found the intellectual atmosphere at Silwood greatly to his liking and he and Judith bought a house nearby where he based himself each summer from the late 70s until his permanent move to the UK. His mastery of the issues in ecology allowed him to engage with people working on very different topics while his insightfulness and background in physics allowed him to make significant advances in each of these areas that transformed the quantitative study of ecology. For example, he and

Michael Hassell developed new models for insect predator-prey systems, and he and Gordon Conway developed more rigorous approaches to integrated pest management. There were other collaborations with visitors from York University such as John Lawton and John Beddington, the latter on models for fisheries and Arctic whaling communities.

It was during these visits that Bob met Roy Anderson and they discussed examining parasites as a special case of predator-prey relationship. The collaboration quickly developed and within a couple of years they had developed the core of a major body of theory that is central to our understanding of the dynamics of infectious diseases and their control. The culmination of this was the massive volume on “Infectious Disease of Humans” (1992) written in a month at the Rockefeller Center in Bellagio, Italy. The work was written at a time when HIV was emerging as the etiological agent of AIDS and they spent a considerable amount of time developing models that provided key understanding for how HIV spread and might be controlled.

The productivity of Bob and his collaborators during his summer visits to Silwood Park was in part due to its unique esprit at the time. Bouts of intense intellectual activity with Imperial faculty and the many students and visitors also present were punctuated by highly competitive sport, with Bob always at the fore. Taking Bob on intellectually or physically was not for the feint-hearted! Bob also initiated an annual four-day walk which began in the English Lake District but then expanded to other British mountains and then from the mid-90s the Alps and other European Mountain Ranges. The participants varied from year-to-year but for 45 years Bob led a diverse group of ecologists and friends up vertiginous mountain tracks, often in driving rain, talking simultaneously of science, science politics and anything else. No one ever died, but as the years went by Bob curated an increasing number of anecdotes about near misses and disasters avoided, only made more perilous by the passage of time.

He was also President of the British Ecological Society, and recipient of the Balzan Prize, Blue Planet Prize and the Swedish Academy’s Crafoord Prize, which he bestowed upon Princeton to help support a rising theoretically oriented graduate student in evolutionary ecology. The British Ecological Society each year also bestows the *Methods in Ecology and Evolution (MEE) Robert May early career researcher award* upon a young researcher. Bob was also awarded the Royal Society’s Copley Medal, one of its oldest and most prestigious award given annually for outstanding achievements in research in any branch of science, and was an International Member of a number of national academies including the U.S. National Academy of Sciences.

He continued to visit Princeton colleagues and friends on almost an annual basis until his declining health made that impossible, and received an honorary degree along with President Bill Clinton at Princeton's 250th anniversary in 1996.

Towards the end of his career he became interested in finance and wrote several insightful and important papers on the mechanisms that led to the financial crash of 2008, and on ways to reduce the possibilities of recurrence. Right to the end he treasured his old and new colleagues alike.

He is survived by his wife, Judith, and their daughter, Naomi.

*Andy Dobson, Charles Godfray, Simon Levin, Steve Pacala, Dan Rubenstein and Jon Seger. This article is an expansion of an article that originally appeared on the Princeton University website.*