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EDITORIAL

Nobel Reflections

The world of science is catapulted into the public eye each year in October, when the Nobel prizes are announced. Recognition from Stockholm is considered the pinnacle of achievement in science; the prestige of the prize conferring an unmatched aura of distinction on its recipients. The awards in science generally recognize work and achievement, which are usually very well known amongst the practitioners of each field. The only discussion that accompanies the awards is on the names of those who have been overlooked, sometimes squeezed out by the limitation that restricts the number of recipients to three. This is in marked contrast to the Peace and Literature Nobel prizes, which generally stir up a lively controversy. In an editorial that appeared days before this year's announcements, the journal *Nature Chemistry* reflected on the soon to be awarded prize, noting that the Nobel Committee's decision would be accompanied by 'the usual speculation, angst, disagreement and elation'. The journal added: 'It has been said that the history of the Nobel Prize is the history of science. This may be true, but only to the extent that history itself is written as the story of monarchs and generals – in other words, ignoring the story of everyday people who make up the bulk of the population' (*Nature Chemistry*, 2009, **1**, 509). I was struck by the phrase 'monarchs and generals', which immediately conjured up visions of dominating, managerial scientists commanding large work-forces, that appear to have become important in the world of 'big science'. Happily, when this year's awards were announced the only 'monarch and general' was awarded the Peace Prize, while the scientists and economists seemed to be model researchers, whose efforts and success may inspire a new generation of committed scientists. The history of science is replete with examples of exemplary work done by individuals and small groups, choosing to work courageously and indefatigably on important and difficult problems; following trails of research that can be formidably difficult and unfashionable, at times.

The Nobel Prize in Physiology or Medicine was an anticipated recognition of the work done by Elizabeth Blackburn, Carol Greider and Jack Szostak, which led to the discovery of 'how chromosomes are protected by telomeres and the enzyme telomerase'. Their findings have implications in the areas of human aging and cancer, raising the hope that new therapeutic approaches to cancer may emerge from studies of inhibition of the enzyme telomerase. This award recognizes basic research in molecular biology, with applications in medicine yet to materialize. Molecular and structural biology has also been emphasized by the award of the prize in Chemistry to Venkataraman (Venki) Ramakrishnan, Thomas Steitz and Ada Yonath, who made independent and remarkable contributions towards determining the detailed atomic level architecture of ribosomes. These magnificently assembled macromolecular complexes are the site of protein synthesis in living cells; they are the stage on which the genetic message is translated into proteins, molecules which are central to all of life's chemistry. Enzymes, of which telomerase is an example, lie at the heart of biochemistry catalysing myriad reactions in cells with astounding specificity and efficiency. In reading of the work of this year's laureates I could not help but recall a statement of the late Arthur Kornberg: 'In my theater the nucleic acids write the script but the enzymes do the acting'. The determination of the atomic level three-dimensional structure of the ribosome is a technical *tour de force*, a tribute to the dramatic progress of X-ray crystallography and cryoelectron microscopy over the past two decades. The ribosome structure reveals a breath-takingly detailed view of the process of protein synthesis; its complexity reminding us of how little we know about the evolution of the chemistry of life (Schmeing, T. M. and Ramakrishnan, V., *Nature*, 2009, doi:10.1038/nature 08403). Nearly half a century ago, in 1962, the Nobel awards in medicine and chemistry recognized the birth of molecular and structural biology, with Watson, Crick and Wilkins honoured for their elucidation of the double helical structure of DNA, while Perutz and Kendrew were recognized for the determination of the first protein structures, haemoglobin and myoglobin, by X-ray crystallography. This year's awards highlight the growing intimacy of chemistry and biology, with the hope that the confluence of these disciplines will fuel the progress of medicine. The ribosome structure provides insights into the mechanisms by which specific antibiotics inhibit protein synthesis in bacteria, promising new lines of attack in the perennial battle against infectious disease. While the Medicine and Chemistry prizes rewarded pure basic research, the Nobel Prize in Physics recognized seminal work that has impacted modern life in spectacular

fashion. Charles Kao's development of optical glass fibres has revolutionized communication. From the first discovery in the mid 1960s to the production of ultrapure fibres which could transmit light over long distances took only a few years; developments which preceded the birth of the Internet by many years. The present day applications of optical fibres could scarcely have been anticipated in the 1970s, reaffirming an old saying that 'the best research will someday be applicable'. The second half of the award in physics recognized 'the invention of an imaging semiconductor circuit – the CCD sensor'. The charge coupled device (CCD) has led to digital photography and is at the heart of a large number of instruments, which must convert light into electrical signals. This is a prize that recognizes work that lies at the borders of engineering and has been one of the drivers of the information revolution. The Economic Sciences prize instituted by the Sveriges Riksbank, in memory of Alfred Nobel, recognizes work in the area of what may be loosely termed as 'behavioural economics'. The laureates, Elinor Ostrom and Oliver Williamson work in distinctly different areas. Ostrom is cited for her work in the 'analysis of governance, especially the commons', while Williamson has been honoured 'for his analysis of economic governance, especially the boundaries of the firm'. Ostrom's work challenges, in the words of the Nobel announcement, 'the conventional wisdom that common property is poorly managed and should be either regulated by central authorities or privatised'. This is an area of great relevance in India, where the management of the 'commons' is an increasingly difficult and contentious arena. Her work contributes in a major way to the debate initiated four decades ago by Garret Hardin in his famous essay on 'The Tragedy of the Commons' (*Science*, 1968, **162**, 1243). Hardin perceived a 'need to impose public or private ownership on all natural resources'. This is a view that Ostrom has challenged by studying the models by which cooperative groups manage common resources. In a recent study she concludes: 'When users are genuinely engaged in decisions regarding rules affecting their use, the likelihood of them following the rules and monitoring others is much greater than when an authority simply imposes rules' (Ostrom, E. and Nagendra, H., *Proc. Natl. Acad. Sci. USA*, 2006, **103**, 19224). I suspect that Ostrom's work may be of special interest to policy makers in India, who wrestle with the problems of the environment, water and land resources.

Inevitably, the Nobel awards stir up a minor controversy or two every year. 2009 is no exception. Chemistry has, in recent years, been redefined by the Nobel Committee. The phenomenal growth of molecular biology has resulted in a dramatic expansion of the borders of chemistry. The award for the work on the green fluorescent protein in 2008 has been followed by the recognition of the ribosome structure this year. Traditional chemistry seems to be out of favour. But even a cursory glance at the structure of the ribosome and what has been learned about the mechanisms of protein synthesis in cells, will reveal a richness of structural and mechanistic chemistry that can hardly be matched in the laboratory. Some years ago I heard a seminar speaker proclaim: 'Chemistry is the engine that powers biology'. It might also be true to say that 'biology is the fuel that powers chemistry today'.

This year's awards had a special significance in India. Venki Ramakrishnan's Indian origins, catalysed a remarkable outpouring of public interest, after the Nobel announcement; even the reflected glory of a Nobel prize can be dazzling, at times. The adulation suddenly dissolved into controversy; the rapid transformation demonstrated the power of the media to influence opinion. Ramakrishnan's understandable discomfort at the deluge of e-mails and phone calls from India and his characterization of his Indian origins as an 'accident of history' have been widely reported and discussed. But even as I write, an extraordinary piece of invective has appeared. While such pieces normally deserve to be ignored, the fact that the author happens to be an articulate Member of Parliament and a 'spokesman of the Congress party' suggest that a comment may be merited. Abhishek Singhvi writing in the *Times of India* (20 October 2009) argues that Ramakrishnan's somewhat plaintive request to be spared the excessive adulation, suggests that he is in some way insensitive to the 'patriotic' urges that come to the fore, when an Indian (or one of Indian origin) gets a major international award. Curiously, Singhvi is aware, as he should undoubtedly be, that patriotism can be 'the refuge of the scoundrel'. He notes that patriotism 'has an intersection of noble values which in this case, appear to have completely escaped the mind of a brilliant Nobel laureate'. Singhvi adds that 'success has many fathers while failure is an orphan', a phenomenon that is also widely observed in the West. Singhvi's diatribe is both distasteful and inappropriate, coming as it does from one who is distinguished in public life. He would do well to remember that scientific success can sometimes be an orphan in India. Ironically, one of the founders of the field of structural biology, an area recognized by this year's Chemistry prize, was an Indian; G. N. Ramachandran who determined the structure of collagen in the 1950s and developed the conformational analysis of protein chains in the 1960s, at Madras University. Ramachandran died in 2001, unhonoured by the Government of India even in the annual Republic Day awards, which are given by the dozen every year. Cholera researchers also celebrate the 50th anniversary of Sambhu Nath De's famous work on cholera toxin this month. De died in 1985 unhonoured even by the Indian scientific community. The fact that Ramachandran and De did not get the call from Stockholm may only be an 'accident of history'. Patriotism can often be misplaced. Our reactions to this year's Nobel prize in chemistry are undoubtedly an example.

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