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EDITORIAL

Alice: Science and Common Sense in Wonderland

Scientists, especially those in academia are required to write scholarly papers; an activity that frequently exposes them to withering, anonymous criticism from their colleagues who serve as peer reviewers. Papers and research proposals, submitted for funding, can draw fire from snipers whose identity and positions remain unknown. Researchers who amass formidable lists of publications must be both resilient and thick skinned. Running repeatedly through the gauntlet of anonymous peer review requires a great deal of staying power. To be unfazed by trenchant criticism is indeed an attribute that is needed for success in science and many other fields. Writers, in general, are fair game for critics. In writing these columns, with a painful regularity, I have encountered my share of criticism. At times, the critics have taken issue with the opinions expressed; on other occasions with the content, sometimes asking why the columns seem to address topics of little relevance, especially when Indian science faces apparently insurmountable problems. My defense has always been that writers, particularly those with deadlines to meet, choose their topics primarily with the intention of producing a passable essay. The task of providing solutions to weighty national problems must inevitably be left to optimists with the imagination and energy to advance strategies that have not been considered before. There are also purists, quick to pounce upon stylistic shortcomings, amongst the tribe of critics. Their sensibilities are easily offended by lapses in grammar and punctuation. Foreign authors who submit papers to American and British journals are often advised to have their manuscripts scrutinized by a 'native English speaker'; tacitly assuming that superior writing skills are possessed by the 'natives'. I have encountered my share of carping critics. A scientific paper of mine once drew a stinging rebuke from a referee who disliked 'split infinitives'; sending me scurrying to find a long forgotten textbook of grammar, in the days before the internet made information searches so comfortable (*Curr. Sci.*, 2004, **86**, 239). More recently, glaring lapses of punctuation were pointed out by a perceptive reader: 'If the commas are not simple typos, I can only think of Thoreau: If a man does not keep pace with his companions, perhaps it is because he hears a different drummer.' Suitably chastised, I consoled myself by recalling the rest of the Thoreau quote: 'Let him step to the music which he hears, however measured or far away.' My weakness for quota-

tions drew a rather plaintive question from a friendly and often, encouraging colleague: 'Why do you have to quote so frequently from *Alice's Adventures in Wonderland*? Must I go and read the book again?'. My fondness for *Alice* is an inherited trait; presumably a combination of both 'nature and nurture', a model favoured by many post-genome geneticists. My father, a bureaucrat, was justly proud, till the very end, that he had successfully quoted from Lewis Carroll's book on the margins of a government file. That was, of course, in the days before the Right to Information Act (RTI) gave everyone the chance to educate themselves by reading notings on government files. Are *Alice* and Carroll's sequel *Through the Looking Glass* truly books for children? Do they only fascinate adults who have refused to grow up or are Carroll's classics educational in a more general sense?

Alice first appeared in 1865 and *Looking Glass* in 1872. Carroll fans will undoubtedly look forward to a grand celebration in 2015, the 150th anniversary of the appearance of a book for children, which has stimulated a large number of scholarly studies seeking to decipher the hidden meaning in a classic that has endured for so long. In 1960, Martin Gardner, the great popularizer of mathematics who died last year, produced the *Annotated Alice*, an invaluable aid to anyone who seeks to uncover the hidden sense, amidst the nonsense of *Wonderland*. Charles Dodgson the Oxford mathematician, immortalized by his pseudonym Lewis Carroll, the creator of *Alice*, lived and wrote at a time when science was on the brink of a major upheaval. Darwin's ideas on the origins of diversity in biology and the imprint of natural selection were beginning to filter through academia in England. Chemistry was stirring restlessly in Europe; atoms and molecules were in the air. Pasteur had announced the resolution of racemic tartaric acid. Stereochemistry had been conceived. Symmetry or the lack of it seemed critical for life. Van't Hoff and La Bel would midwife the tetrahedral carbon atom into existence in 1874, barely three years after Carroll produced *Looking Glass*. Physics and physicists viewed with some unease the imagery of 19th century chemistry. Atoms, valencies and chemical formulae seemed artificial devices to rationalize a craft that seemed to have descended from the alchemy of the earlier centuries. The structure of matter was shrouded in mystery, although the properties of matter seemed so wonderfully useful. This sense of unease pervaded to the

remarkable attributes of space, empty space, a mystical aether through which natural phenomena seemed linked. Faraday and Maxwell had united electricity and magnetism; light seemed to emerge from this union. Boltzmann, ‘an early follower of Darwin’ in the words of Bronowski, had begun to grasp the reality of the atom and to link heat and disorderly motion. Entropy and chaos would have been welcome in Alice’s wonderland. Physics in Carroll’s time was teetering on the brink of a new order in which space and time would meet in a manner that most of us find decidedly strange, even a century later. Did physics, chemistry and biology intrude into Carroll’s thinking; was the mathematician and logician Charles Dodgson speaking of strange, new views of the world through the enduring characters in the mad world of wonderland?

In musing about my colleague’s question about *Alice*, I was delighted to chance upon Gillian Beer’s essay, *Alice in Time* that appeared recently in *Nature* (2011, **479**, 38). The author, an emeritus professor of English literature and an academic of great distinction, explores ‘the passage of time in its many manifestations through Lewis Carroll’s enduring classics. Time enters *Wonderland* when the White Rabbit pulls a stopwatch out of his waistcoat pocket and hurries on muttering to himself “*Oh dear! Oh dear! I shall be too late!*” Alice follows him down the rabbit hole falling endlessly, in a way that gravity and Newton seemed to misbehave, as she tumbled into *Wonderland*. Beer notes that photography, invented in Carroll’s time ‘froze and made portable a moment and a place’. She adds that from the 1850s Hermann von Helmholtz, physicist and physiologist, was interested in ‘the measurement of the nerve impulse’, in attempting to understand ‘the speed of thought and reaction time’. Beer points out that Helmholtz ‘summarized many non-Euclidean insights of the previous two decades’, in 1870. Beer notes that Helmholtz concluded by citing German mathematician Georg Riemann’s ‘somewhat startling conclusion, that the axioms of Euclid may be, perhaps, only approximately true’. Life in worlds of different dimensions seemed to tease the imagination. Beer concludes that ‘Carroll did not follow this non-Euclidean thinking professionally but let it loose in his fiction’. Alice’s changing shape and sizes as she stumbles through *Wonderland* can fascinate children; in the many movie versions of *Alice* they can be frightening. In Beer’s words: ‘The child’s everyday and helpless experience of growing, and of being always the wrong size in a world designed by adults, is meshed with mathematical speculation.’ Time and space intrude in special ways in *Through the Looking Glass*. Beer suggests that Carroll seems to have conceived the story ‘on the plane of a chessboard, later adding the optical reversing effects of the mirror’. He appears to have been influenced ‘by his friend J. J. Sylvester’ who in a ‘presidential address to the 1866 British Association for the Advancement of Science’ discussed reaching out to a fourth dimension. In Beer’s

analysis, ‘Alice becomes aware that our mode of living in time is not the only pattern available’. She recalls the Red Queen’s dismissal of Alice’s world where days come one at a time: *That’s a poor thin way of doing things. Now here, we mostly have days and nights two or three at a time, and sometimes in winter we take as many as five nights together – for warmth, you know.* The Mad Hatler’s tea party, in Beer’s essay, may have anticipated Georg Cantor’s ‘degrees of infinity as well as an infinite infinity’.

Alice scholars find not only allusions to mathematics and physics in Carroll’s books; chemistry and biology also make an appearance. Jack Dunitz in presenting an overview of ‘symmetry arguments in chemistry’ notes that Carroll ‘makes several references to the left/right dichotomy’ in *Looking Glass*. Alice’s musing to her kitten: ‘Perhaps looking-glass milk isn’t good to drink’ is now quoted in most discussions of molecular chirality. Dunitz notes that *Looking Glass* ‘was published in 1872, at a time when chemical structural theory was being challenged by the recent finding that a substance present in muscle appeared to be identical with lactic acid obtained by fermentation of milk, except that solutions of the two substances rotated plane polarized light in opposite senses’ (Dunitz, J. D., *Proc. Natl. Acad. Sci. USA*, 1996, **93**, 14260). The Dodo, a bird that once lived in a predator-free island, Mauritius, appears as the master-of-ceremonies in the Caucus Race, where everyone gets a prize. The Portuguese arrived in Mauritius in 1513; by 1681 the Dodo was extinct. It had no known enemies until the European colonisers appeared (*Curr. Sci.*, 2003, **85**, 5). Carroll had presumably read Darwin. Even researchers in linguistics turn to Alice. In *Looking Glass* Alice introduces herself to Humpty-Dumpty who is dismissive:

‘*“It’s a stupid name, enough!” Humpty-Dumpty interrupted impatiently. “What does it mean?”*
“Must a name mean something?” Alice asked doubtfully.
“Of course it must,” Humpty-Dumpty said with a short laugh: “My name means the shape I am – and a handsome shape it is too. With a name like yours, you might be any shape, almost.”’

This quote opens an article which draws attention to recent studies suggesting ‘that we seemingly link certain sounds with particular sensory perceptions’ (Robson, D., *New Scientist*, 2011, **2821**, 30).

The *Alice* books are a source of thoughts and original ideas camouflaged in seeming absurdity. There is a great deal of sound common sense in the words of the inimitable inhabitants of wonderland. Is there advice for readers who have not encountered *Alice* in adulthood. Carroll provides sage counsel:

‘*The White Rabbit put on his spectacles, “Where shall I begin, please your Majesty?” he asked.*
“Begin at the beginning,” the King said gravely, “and go on till you come to the end: then stop.”’

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