Richard Dawkins

BOOKS DO FURNISH A LIFE

Reading and Writing Science

EDITED BY GILLIAN SOMERSCALES

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About the Author

Richard Dawkins was first catapulted to fame with his iconic work of 1976, *The Selfish Gene*, which he followed with a string of prestigious bestselling books including *The Blind Watchmaker*, *Climbing Mount Improbable*, *The Ancestor's Tale* and *The God Delusion*. He is also the author of the anthologies *A Devil's Chaplain* and *Science in the Soul* and two volumes of autobiography, *An Appetite for Wonder* and *Brief Candle in the Dark*. He is a Fellow of both the Royal Society and the Royal Society of Literature, and the recipient of numerous honours and awards. He remains a fellow of New College, Oxford. In 2013, Dawkins was voted the world's top thinker in *Prospect* magazine's poll of 10,000 readers from over a hundred countries.

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@richarddawkins

ALSO BY RICHARD DAWKINS

The Selfish Gene
The Extended Phenotype
The Blind Watchmaker
River Out of Eden
Climbing Mount Improbable
Unweaving the Rainbow
A Devil's Chaplain
The Ancestor's Tale
The God Delusion
The Greatest Show on Earth
The Magic of Reality (*with Dave McKean*)
An Appetite for Wonder
Brief Candle in the Dark
Science in the Soul
Outgrowing God

www.richarddawkins.net

In memory of
Peter Medawar

Editor's Introduction

Never has the communication of science been more important than it is today. If, as Francis Bacon – literal and figurative Renaissance man – believed, knowledge itself is power, then never have humans had more power to act in ways beneficial to the future of the planet, its very fabric and its myriad inhabitants – and yet never, it seems, have they had less political will to make the necessary changes.

We live in a time when scientific knowledge and technological advance seem to be far outstripping the will to use them wisely. So a great burden falls on those with the knowledge that can inform human decision-making across the gamut of political, social, educational and commercial activity, and on those with the linguistic talent to command attention, to entice, to startle, above all to persuade. Those with both are the people who can, and who must, today speak truth to power if humanity is not to waste its potential in wasting the planet.

As I write this, humanity is hearing the loudest wake-up call that has rung out for many years, as the Covid-19 pandemic spreads across the world. Huge amounts of dedicated endeavour, political will, popular passion and rapid action have gone into efforts to combat this disease, its causes and its effects, all in a matter of months. One could forgive a cynic for noting the contrast with the laggardly response over decades to the long, slow burn of climate change – which is still going on while we all try to save our own lives and livelihoods. On both fronts, we rely on science to show us ways to cope, ways to survive, ways to improve; and we rely on scientists not only to do their complex, painstaking, demanding work, but to tell the rest of us what they are doing, and how, and the likely effects of their discoveries.

Never, then, has the communication of science been more important; and never has there been more pressure on the communicators. We live amid a multiplicity of media outlets, a barrage of multiway argument, revelation and contestation, a plethora of on- and offline academic publishing streams, constant quick-fire exchanges on social (and all too often anti-social) media. Where in this cacophony are we to find patient argument alongside passionate partisanship, the excitement of discovery alongside the determined discipline of interrogation, all in the cause of reason and science, respect and responsibility for this Earth we inhabit?

Well, we can read Richard Dawkins, for a start. Fortunately for the rest of us, there are across the world a great number of determined individuals – thinkers, researchers, speakers, writers – dedicated to the work of both doing and communicating science. They work alone and in teams, standing on the shoulders of giants, joining hands with their coevals, reaching out to inform and draw in those outside their own circles. Richard Dawkins is one of the most eminent of them – and, with characteristic energy and generosity of spirit, he is also one of the most active in promoting the efforts of others engaged in the same enterprise.

Hence this collection of short writings by an acknowledged master of the art of scientific communication. All are in one way or another connected with books, mostly science books – the books that have furnished Richard's life in science. The forewords,

afterwords, introductions, reviews, essays reproduced here have all been composed to support, criticize or comment on work produced by others; to contribute to the vital task of spreading what we know through scientific method to be true, and defending it from those who would deny it, refuse it, misrepresent it.

In a volume all about communication, what better way to introduce each section than with a conversation? Each of the six parts of this collection begins with the edited transcript of a dialogue between Richard and another writer which reflects on its themes and relates them to the pressing issues of our time. And the collection as a whole is introduced by a new essay Richard has written specifically for this volume, in which he reflects upon 'The literature of science'.

The work of scientific communication is never-ending. We should all be grateful to those who have dedicated their lives to it – not only for the science they do, but for the words they write, both in and about the books with which we may furnish our own lives.

G.S.

Author's Introduction

The Literature of Science

Literature:

a ... that kind of written composition valued on account of its qualities of form or emotional effect.

b The body of books and writings that treat of a particular subject.

(*Shorter Oxford English Dictionary*)

One of my teachers at Oxford encountered a junior colleague deep in the science branch of the Bodleian Library and stooped to murmur in the engrossed reader's ear. 'Ah, dear boy, I see you are consulting the literature. Don't. It will only confuse you.' 'Consulting' and 'the' give the game away. He was using 'literature' in the special way scientists do, a version of the *OED*'s '**b**' definition above. 'The' literature, for a scientist, is all those papers, often abstrusely and densely written, which pertain to a particular research topic. John Maynard Smith was once heard to say, 'There are those who read the literature. I prefer to write it.' His witticism didn't do himself justice, for he was a generous scholar who scrupulously read and credited the work of other scientists. But his quip again serves to illustrate the two meanings of 'literature'.

By 'the literature of science' in this essay, I mean something closer to the '**a**' definition from the *OED* above. I am talking about science as literature, good writing on the theme of science. This usually means books rather than scientific journals. As an aside, I think that's a pity. There's no obvious reason why a scientific paper shouldn't be gripping and entertaining. No reason why scientists shouldn't enjoy the articles it is their professional duty to read. During my spell as editor of the journal *Animal Behaviour* I tried to encourage authors to forsake not only the self-effacing scientific passive ('A different approach will be taken by the present author') but also the traditional and dreary 'Introduction, Methods, Results, Discussion' convention, in favour of telling a story. But now, to books.

I said 'good writing about science' and that may give the wrong impression. It doesn't have to mean 'fine' writing, certainly not if that conveys – as it can – a mood of pretentiousness, or *belles lettres.* I shall come on to Peter Medawar, the dedicatee of this book, in the second half of this essay for he was, in my opinion, the master of scientific literature in the sense that I intend. In his words, 'a scientist's fingers, unlike a historian's, must never stray toward the diapason'. Well, perhaps not quite never. The occasional purple passage is justified by the romance of science – the unimaginable scale of the expanding universe, the stately majesty of geological deep time, the complexity of a living cell, coral reef or tropical rainforest. The natural-history prose poetry of a Loren Eiseley or Lewis Thomas, the cosmic reveries of Carl Sagan, the

prophetic sagacity of Jacob Bronowski? Medawar would not – certainly should not – censor them.

Science doesn't need languaging-up to make it poetic. The poetry is in the subject matter: reality. It needs only clarity and honesty to convey it to the reader and, with a little extra effort, to deliver that authentic tingling up the spine which is sometimes thought the prerogative of art, music, poetry, 'great' literature in the conventional sense. That sense is the one embraced by the awarders of the Nobel Prize in Literature. It explains why the prize is almost always given to a novelist or poet or playwright, occasionally to a philosopher, so far never to a real scientist. The only arguable exception is Henri Bergson who, if he could be called a scientist at all, sets a distinctly unfortunate precedent. I wonder whether it has simply never occurred to the Nobel committee that science – the poetry of reality – is a suitable vehicle for great literature. Here's Sir James Jeans, writing in 1930 of *The Mysterious Universe*:

> Standing on our microscopic fragment of a grain of sand, we attempt to discover the nature and purpose of the universe which surrounds our home in space and time. Our first impression is something akin to terror. We find the universe terrifying because of its vast meaningless distances, terrifying because of its inconceivably long vistas of time which dwarf human history to the twinkling of an eye, terrifying because of our extreme loneliness, and because of the material insignificance of our home in space – a millionth part of a grain of sand out of all the sea-sand in the world. But above all else, we find the universe terrifying because it appears to be indifferent to life like our own; emotion, ambition and achievement, art and religion all seem equally foreign to its plan.

Carl Sagan later said something similar in his famous *Pale Blue Dot* soliloquy:

> Look again at that dot. That's here. That's home. That's us. On it everyone you love, everyone you know, everyone you ever heard of, every human being who ever was, lived out their lives. The aggregate of our joy and suffering, thousands of confident religions, ideologies, and economic doctrines, every hunter and forager, every hero and coward, every creator and destroyer of civilization, every king and peasant, every young couple in love, every mother and father, hopeful child, inventor and explorer, every teacher of morals, every corrupt politician, every 'superstar,' every 'supreme leader,' every saint and sinner in the history of our species lived there – on a mote of dust suspended in a sunbeam.
>
> The Earth is a very small stage in a vast cosmic arena. Think of the rivers of blood spilled by all those generals and emperors so that, in glory and triumph, they could become the momentary masters of a fraction of a dot. Think of the endless cruelties visited by the inhabitants of one corner of this pixel on the scarcely distinguishable inhabitants of some other corner, how frequent their misunderstandings, how eager they are to kill one another, how fervent their hatreds.
>
> Our posturings, our imagined self-importance, the delusion that we have some privileged position in the Universe, are challenged by this point of pale light. Our planet is a lonely speck in the great enveloping cosmic dark. In our obscurity, in all this vastness, there is no hint that help will come from elsewhere to save us from ourselves.

> The Earth is the only world known so far to harbor life. There is nowhere else, at least in the near future, to which our species could migrate. Visit, yes. Settle, not yet. Like it or not, for the moment the Earth is where we make our stand.
>
> It has been said that astronomy is a humbling and character-building experience. There is perhaps no better demonstration of the folly of human conceits than this distant image of our tiny world. To me, it underscores our responsibility to deal more kindly with one another, and to preserve and cherish the pale blue dot, the only home we've ever known.

In 2013 Carolyn Porco who, together with Neil deGrasse Tyson, is the nearest approach we have to a Carl Sagan *de nos jours*, initiated a beautiful commemoration by inviting the world's population to look up and smile at the camera, as her Cassini imaging team photographed us from Saturn, 'Pale Blue Dot' range, 898 million miles:

> Look up, think about our cosmic place, think about our planet, how unusual it is, how lush and life-giving it is, think about your own existence, think about the magnitude of the accomplishment that this picture-taking session entails. We have a spacecraft at Saturn. We are truly interplanetary explorers. Think about all that, and smile.

For me, Carolyn had already earned her niche in the gallery of poetic scientists when she raced against time to have the ashes of her beloved mentor Eugene Shoemaker, narrowly denied in life his ambition to be the first geologist on the moon, included in the payload of a rocket that was about to go there, accompanied by these lines chosen by her from Shakespeare:

> And when he shall die,
> Take him and cut him out in little stars,
> And he will make the face of heaven so fine
> That all the world will be in love with night
> And pay no worship to the garish sun.[fn1]

Peter Atkins, one of the finest English stylists among living scientists, takes the terror of the empty void and tames it with a blithe insouciance which some might condemn as scientistic but which I find magnificent:

> In the beginning there was nothing. Absolute void, not merely empty space. There was no space; nor was there time, for this was before time. The universe was without form and void.
>
> By chance there was a fluctuation, and a set of points, emerging from nothing and taking their existence from the pattern they formed, defined a time. The chance formation of a pattern resulted in the emergence of time from coalesced opposites, its emergence from nothing. From absolute nothing, absolutely without intervention, there came into being rudimentary existence. The emergence of the dust of points and their chance organization into time was the haphazard, unmotivated action that brought them into being. Opposites, extreme simplicities, emerged from nothing.

Lawrence Krauss develops a similar theme in *A Universe from Nothing*, for which I wrote the afterword (see pages 353–7 below). The book from which I took the Atkins

quote, *The Creation*, ends with a fanfare of confidence in the power of science:

> When we have dealt with the values of the fundamental constants by seeing that they are unavoidably so, and have dismissed them as irrelevant, we shall have arrived at complete understanding. Fundamental science then can rest. We are almost there. Complete knowledge is just within our grasp. Comprehension is moving across the face of the Earth, like the sunrise.

The chemist Peter Atkins could fairly be called a prose poet but he never lets style take precedence over clarity. Now, here is a biologist who sees the world through the eyes of a poet, but still decidedly scientific eyes, Loren Eiseley:

> Since the first human eye saw a leaf in Devonian sandstone and a puzzled finger reached to touch it, sadness has lain over the heart of man. By this tenuous thread of living protoplasm, stretching backward into time, we are linked forever to lost beaches whose sands have long since hardened into stone. The stars that caught our blind amphibian stare have shifted far or vanished in their courses, but still that naked, glistening thread winds onward. No one knows the secret of its beginning or its end. Its forms are phantoms. The thread alone is real; the thread is life.[fn2]

The scientist and medical doctor Lewis Thomas writes the facts of reality and then strikes the imaginative spark that moves prose towards poetry:

> We live in a dancing matrix of viruses; they dart, rather like bees, from organism to organism, from plant to insect to mammal to me and back again, and into the sea, tugging along pieces of this genome, strings of genes from that, transplanting grafts of DNA, passing around heredity as though at a great party.[fn3]

You don't have to see viruses like that. The bare facts permit, but do not dictate, the literary image. Yet once it has been added, the reader better sees the point. Here's Lewis Thomas (in *The Lives of a Cell* again) on mitochondria:

> We are not made up, as we had always supposed, of successively enriched packets of our own parts. We are shared, rented, occupied. At the interior of our cells, driving them, providing the oxidative energy that sends us out for the improvement of each shining day, are the mitochondria, and in a strict sense they are not ours.

My former Oxford colleague Sir David Smith found an apt literary allusion in making a related point. Mitochondria have become so thoroughly integrated into the host cell that their origin as invading bacteria was only recently understood.

> In the cell habitat, an invading organism can progressively lose pieces of itself, slowly blending into the general background, its former existence betrayed only by some relic. Indeed, one is reminded of Alice in Wonderland's encounter with the Cheshire Cat. As she watched it, 'it vanished quite slowly, beginning with the tail, and ending with the grin, which remained some time after the rest of it had gone'.[fn4]

Peter Medawar, the Nobel Prize-winning zoologist and immunologist to whom this book is dedicated, was, I think, the greatest literary stylist among the scientists of the twentieth century and I shall use him as my exemplar for the next part of my essay. He was certainly the wittiest scientist I ever met. Indeed, if I were asked for a definition of 'wit' as opposed to simply telling jokes, I might define it ostensively as 'just about anything Peter Medawar ever wrote for the general public'. Listen to this, the opening words of his 1968 Romanes Lecture in Oxford, on 'Science and Literature':

> I hope I shall not be thought ungracious if I say at the outset that nothing on earth would have induced me to attend the kind of lecture you may think I am about to give.

That wonderful Medawarian sally prompted a literary scholar, in his critical reply, to remark, 'This lecturer has never been thought ungracious in his life.'

Medawar could be cutting, he could ridicule, he had no patience with pretentious cant. But he never descended to vulgar abuse. His lampooning of what we might call 'francophoneyism' (I like to think Peter would have enjoyed the word) was merciless: his wit, that insouciant patrician mastery, the kind of thing that makes you want to rush out into the street when you read it, to show somebody – anybody. As a true stylist who used style in the service of clarity, he made short work of those self-regarding 'intellectuals' who raised style above content:

> Style has become an object of first importance, and what a style it is! For me it has a prancing, high-stepping quality, full of self-importance; elevated indeed, but in the balletic manner, and stopping from time to time in studied attitudes, as if awaiting an outburst of applause. It has had a deplorable influence on the quality of modern thought ...

Returning to attack the same targets from another angle, Medawar wrote:

> I could quote evidence of the beginnings of a whispering campaign against the virtues of clarity. A writer on structuralism in the *Times Literary Supplement* has suggested that thoughts which are confused and tortuous by reason of their profundity are most appropriately expressed in prose that is deliberately unclear. What a preposterously silly idea! I am reminded of an air-raid warden in wartime Oxford who, when bright moonlight seemed to be defeating the spirit of the blackout, exhorted us to wear dark glasses. He, however, was being funny on purpose.

Medawar ended this lecture on science and literature with a resounding declaration of his own:

> In all territories of thought which science or philosophy can lay claim to, including those upon which literature has also a proper claim, no one who has something original or important to say will willingly run the risk of being misunderstood; people who write obscurely are either unskilled in writing or up to mischief. The writers I am speaking of are, however, in a purely literary sense, extremely skilled.

The obscurantism in question positively pleads to be satirized, and the physicist Alan Sokal rose to the occasion. His 'Transgressing the boundaries: towards a

transformative hermeneutics of quantum gravity' is a sublime masterpiece: utter nonsense from start to finish, yet accepted for publication in a pretentious journal of literary culture, no doubt because meaningless gibberish was precisely what the journal existed to publish. More recently, Peter Boghossian, James Lindsay and Helen Pluckrose fooled journal editors into publishing a flurry of similar lampoons, this time satirizing what they called 'Grievance Studies': the politically influential genre of 'More Victim than Thou' self-pity. How Peter Medawar would have relished these hoaxes. Also the 'Postmodernism Generator', a computer program designed to churn out an indefinite number of spoof articles, indistinguishable from the senseless 'postmodern' real thing.

If you should feel there's something genially anti-French in my quotations from Medawar himself, your suspicions would not be allayed by the following, from his review of Pierre Teilhard de Chardin's *The Phenomenon of Man* – a candidate for the finest negative book review ever written.[fn5] But his targets are not limited to French intellectuals and their fellow-travellers. The contrast he makes with a once dominant school of German thought – 'these tuba notes from the depths of the Rhine' (what an image, how exquisitely Medawar!) – shows him to have been an equal opportunity pretension-puncturer:

> *The Phenomenon of Man* stands square in the tradition of *Naturphilosophie*, a philosophical indoor pastime of German origin which does not seem even by accident (though there is a great deal of it) to have contributed anything of permanent value to the storehouse of human thought. French is not a language that lends itself naturally to the opaque and ponderous idiom of nature-philosophy, and Teilhard has accordingly resorted to the use of that tipsy, euphoristic prose-poetry which is one of the more tiresome manifestations of the French spirit.

The affable good humour blunts the barbs, so that offence can hardly be taken. Once again, 'This lecturer has never been thought ungracious in his life.' Yet at the same time, though superficially blunted, the barbs somehow contrive to remain as sharp and penetrating as ever. Such a contrast to Samuel Johnson, in Peter's own splendid characterization, 'wielding, as ever, the butt end of his pistol'.

The conclusion of the Teilhard review takes on not just Teilhard himself but an entire underworld (he chose the word advisedly, as we shall see) of out-of-its-depth literary culture:

> How have people come to be taken in by *The Phenomenon of Man*? We must not underestimate the size of the market for works of this kind, for philosophy-fiction. Just as compulsory primary education created a market catered for by cheap dailies and weeklies, so the spread of secondary and latterly tertiary education has created a large population of people, often with well-developed literary and scholarly tastes, who have been educated far beyond their capacity to undertake analytical thought. It is through their eyes that we must attempt to see the attractions of Teilhard.

'Educated far beyond their capacity to undertake analytical thought.' Isn't that delicious beyond words?

Did Peter sometimes go too far? Women friends of mine have bridled at his explanation for the title of one of his books, *Pluto's Republic*:

> A good many years ago a neighbour whose sex chivalry forbids me to disclose exclaimed upon learning of my interest in philosophy: 'Don't you just adore Pluto's *Republic*?'

He certainly had a highly developed sense of mischief. When, at an unusually young age and still not well known, he was newly elected Jodrell Professor at University College, London, John Maynard Smith asked J. B. S. Haldane what this chap Medawar was like. Haldane tersely paraphrased Shakespeare: 'He smiles and smiles, and is a villain.' Do *we* conceal a guilty, vicarious mischief ourselves when we hug ourselves with delight at the following, in 'Lucky Jim', Medawar's review of James Watson's *The Double Helix*:

> It just so happens that during the 1950s, the first great age of molecular biology, the English schools of Oxford and particularly of Cambridge produced more than a score of graduates of quite outstanding ability – much more brilliant, inventive, articulate and dialectically skilful than most young scientists; right up in the Jim Watson class. But Watson had one towering advantage over all of them: in addition to being extremely clever he had something important to be clever about.[fn6]

I think a certain amount of offence *was* taken at that, for which Peter, gracious as ever, offered a kind of half apology. And he had the enormous advantage of being – at a level possibly unprecedented in the annals of Nobel scientists – deeply read and cultivated in literature. A real polymath – to use that overworked word in its true sense – who could hold his own against scholars in almost any field as well as his own.

His polymathy calls to mind his generous, and beautifully written, pen portrait of a genuine hero, D'Arcy Thompson:[fn7]

> an aristocrat of learning whose intellectual endowments are not likely ever again to be combined within one man. He was a classicist of sufficient distinction to have become President of the Classical Associations of England and Wales and of Scotland; a mathematician good enough to have had an entirely mathematical paper accepted for publication by the Royal Society; and a naturalist who held important chairs for sixty-four years ... He was a famous conversationalist and lecturer (the two are often thought to go together, but seldom do), and the author of a work which, considered as literature, is the equal of anything of Pater's or Logan Pearsall Smith's in its complete mastery of the bel canto style. Add to this that he was over six feet tall, with the build and carriage of a Viking and with the pride of bearing that comes from good looks known to be possessed.

Did Peter know how much of himself was in that description? I doubt it. If I am asked to name a single scientist whom I regard as a role model, and more particularly a single author whose writing style inspired me more than any other, I would nominate that other aristocrat of learning, Peter Medawar.

Without being in the Medawar class, a scientist can deeply love literature and many do. Books have always been an important part of my life. Unlike many biologists I came to my subject not through a love of birds or natural history in the wild (that came later) but through books and a preoccupation with the deep philosophical questions of existence. My childhood devotion to Doctor Dolittle kindled my love of animals and my

moral concern for their welfare. In *Science in the Soul* I even compared Hugh Lofting's protagonist to my own gentle hero, Charles Darwin, the young 'Philos' of the *Beagle*. I progressed to the *Eagle* comic and 'Dan Dare, Pilot of the Future'. The romance of space travel gripped me, even though the science was unnecessarily slipshod (you don't seize the joystick and zoom off in the general direction of Venus; you have to compute orbits, schedule slingshots and harness the calculated power of gravity). Later, the novels of Arthur C. Clarke put me straight on such solecisms and led me to a love of science fiction.

My schoolfriends and I avidly discussed the moral and political implications of *Brave New World* and moved on to Aldous Huxley's other novels which, though not science fiction in themselves, are manifestly written by someone deeply read in science and with an inside track on the minds and emotions of those who practise it. Scientists such as the dreamy Lord Tantamount in *Point Counterpoint* are among Huxley's most sympathetic characters. His *After Many a Summer*[fn8] is surely influenced by his scientific reading, including his brother Julian's research on axolotls, injecting them with thyroid hormone and turning them into salamanders never before seen. We are juvenile apes; so, if we lived two hundred years, would we turn into hairy quadrumana like Huxley's fictional Earl of Gonister?

I have learned some of my science from reading science fiction (see for instance my foreword to Fred Hoyle's *The Black Cloud* on page 79), and this leads me to wonder why it might sometimes take fiction to teach such lessons. Why do we enjoy fiction? What is the fascination of stories about non-existent people and things that never happened, and why do we turn to them for light relief after reading about things that did? Hardly a good example of light relief, but why did William Golding write *Lord of the Flies* as fiction, when he could have penned a prophetic treatise on human psychology with serious predictions of what would happen if a group of schoolboys should be marooned on an island with no adults? H. G. Wells did it both ways: prophetic fiction such as *The Time Machine*; and non-fictional speculation in his remarkable (and to modern readers deplorable in parts) *Anticipations of the Reaction of Mechanical and Scientific Progress upon Human Life and Thought.* But what is it that makes fiction so palatable? I think I dimly understand some kind of answer, but I am no literary scholar and it would be presumptuous of me to rush in where Henry James, E. M. Forster and Milan Kundera have trod.

The title I have chosen for the present volume – *Books Do Furnish a Life* – reflects the love of books that has led me, over many years, to accept invitations to write forewords, introductions or afterwords to books that I admire, to contribute to collections of essays, and to write reviews of books that I might (or, less often, might not) admire. There follows a selection of these pieces, put together in collaboration once again with Gillian Somerscales (for whose literate conscientiousness I am, as ever, immensely grateful). Any of them could have featured in our previous anthology, *Science in the Soul*, but it made excellent sense to keep them back for a separate volume of book-related writings – a collection that I hope reflects something of the range and quality of the literature of science.

I

TOOLS OF TWO TRADES: WRITING SCIENCE

In conversation with Neil deGrasse Tyson

On science and scientists, in public and private

In April 2015 I met Neil deGrasse Tyson, Director of the Hayden Planetarium, at his office in New York. We talked for nearly an hour and a half, ranging over many topics of passionate concern to us both, and our conversation was filmed and recorded for Neil's radio show *StarTalk*. The following is an abbreviated transcript of parts of that conversation.

Are we just not wired up to think logically? Would you trust a doctor who you know holds unscientific beliefs? How do you get people to change their minds? How many scientists are religious – and does it matter?

NDT: So I've got here, live in the flesh, the one, the only, the inimitable Richard Dawkins. Richard, thanks for coming.

RD: Thank you very much.

NDT: I want to talk to you about the human mind's capacity to know, and to think, and to believe. You know, I look at how much trouble people have with mathematics, typically. If there's any one subject that the most number of people say 'I was never good at—', it's going to be math. And so I say to myself, 'If our brain were wired for logical thinking, then math would be everyone's easiest subject.' Everything else would be harder. So I'm kind of forced to conclude that our brain is not wired for logic.

RD: It's a very good point. And it's more than just that. I think there's also a kind of unwarranted pride in being bad at mathematics. You will never hear anybody saying how proud they are at being ignorant of Shakespeare, but plenty of people will say they are proud of being ignorant of mathematics.

NDT: Or if they don't use the word 'proud' they'll say, 'I was never good at math, ha ha ha' – they'll chuckle about it. Like it's a joke.

RD: Yes. There was a piece in one of the British newspapers where a science writer – I think a science journalist – was lamenting the fact that many people in Britain think it takes one month for the Earth to orbit the sun, and the editor inserted there: 'Doesn't it? – Ed'. So he was, as it were, saying, 'I'm the editor of a national newspaper, and of course I don't think it really takes a month – but nevertheless it's OK to make a joke about being ignorant of this elementary point of astronomy,' which you would never, ever do about confusing Byron with Virgil or something like that—

NDT: Or ever be proud of such a thing. So, then you must admit that we as a human organism must have a great challenge before us to think rationally, logically, scientifically.

RD: Yes. You made the very interesting point that maybe we are not wired to be good at logic – well, you generalized from mathematics to logic – but I think it's an interesting point that our wild ancestors, needing to survive in the presence of lions and drought and famine and things ... you'd think logic would be pretty important for survival – if not mathematics.

NDT: Well, maybe there were early people who said, 'Oh, there's a creature there with big teeth. Let me investigate it further ...'

RD: Yes. In a way, that's right: to be curious might be a bad thing.

NDT: Curiosity doesn't always work.

RD: I had a cousin who, as a little boy, put his finger in the mains and got a shock, so he did it again just to make sure! So he was a real scientist, but that's not very good for survival.

NDT: Right! So perhaps the gut reaction to run, or to be scared, or to ... chant ... I guess what I'm getting at is there's so much of human civilization that derives, not from logical thinking, but from what we might simply call illogical thinking. Take illogical thinking and, say, art: I've got Van Gogh on the wall but no one's going to quiz him and say, 'How logical were you when you painted the starry night?' So what does it mean to object, then, to people who feel this way? Because I detach myself more from that battle than you do. You are on the front lines and I'm way back watching you do this, and I'm saying sometimes people just want to – feel, rather than think.

RD: Yes. I keep pushing back to the evolutionary origins of this. When you have to survive in a hostile environment, it may be that you do need a certain amount of illogical—

NDT: Gut feeling.

RD: Yes. It may be that you need to fear things which logic tells you you needn't ... but maybe it's a matter of the odds that something is actually dangerous.

NDT: Or the cost to you if it is.

RD: The cost to you. If you see a sort of rustling in the trees, it could be a leopard about to jump on you but it's much more likely to be the wind, and the logical, rational explanation is probably it's the wind. But when your survival depends upon the remote possibility – well, in fact not remote, the rather lower probability that it might be a leopard, the prudent thing is to be more risk averse than—

NDT: Than the statistics justify.

RD: Exactly, yes.

NDT: OK. So now we have a world where ... we're prisoners of this genetic moulding that has occurred; and I guess my point is I don't object as much to that as you do.

RD: Yes, OK.

NDT: And ... what's the phrase, it sticks in your craw? So, OK ... bring it on!

RD: A former professor of astronomy at Oxford told me a story of an American astrophysicist who writes learned articles in astronomical journals, mathematical papers, and the mathematics is premised on the belief that the universe is between 13 and 14 billion years old. And this man writes his papers and he does his mathematics and everything – and yet he privately believes the world is only six thousand years old. Well, you may be tolerant of that because

you may say, 'Well, as long as he gets his sums right, as long as his paper is well-researched ...'

NDT: A well-researched paper, yes.

RD: I would say that man should be fired. He should not be a professor of astrophysics in an American university. And we might differ about that, because you might say his private beliefs are private, they're nothing to do with me, if he does his astronomy right then that's OK.

NDT: Yes, I agree with you that that's how I would react. What he does at home, on Sunday, that's his own thing – if it doesn't enter the science classroom then I don't care how he thinks.

RD: OK, then let me take an even more extreme example. It's fictitious in this case. Imagine you were going to consult a doctor, and I'll make him an eye doctor because they're sort of ... above the waist, but you happen to know that he privately doesn't believe in the sex theory of reproduction. He believes that babies come from storks.

NDT: OK. I wouldn't go to that doctor.

RD: You wouldn't go to that doctor, but I've met plenty of people – especially in America – who say, 'It's not any of your business what he believes below the waist ... he's an eye doctor. Is he competent? Can he repair your cataracts?' I don't think he should be employed in a hospital because what you're saying about that man is that he's got the kind of mind which is so adrift from reality that even if he's a competent eye surgeon, I don't think he could be trusted.

NDT: OK, so – interestingly – you're reacting in the way our ancestors hearing the rustle in the bushes are reacting, because most of the time it's wind, some of the time it's a leopard and that creates a fear factor that overrides everything else. He's a good eye surgeon, he or she is a good eye surgeon, but there's that lingering risk that the stork theory of reproduction might somehow affect the scalpel. So you fear that risk.

RD: I'm not sure it needs to affect the scalpel; I think it's something—

NDT: OK, so then you object on principle.

RD: I think so, yes.

NDT: Yes, not on practice. It's a principle thing.

RD: Take a professor of geography who believes in the flat Earth but—

NDT: —but otherwise makes perfect globes.

RD: Yes, quite. Yes, exactly. There are such people ...

NDT: OK, so you're a principle person. You want the whole package to be consistent.

RD: I think so.

NDT: OK, so now, given that, what do you do about it? Because I don't really do anything. You want to change that; and we just admitted together that we are prisoners of mystical, magical ways of thinking – or illogical ways of thinking – and so you want to change the biological directive of the human mind. How do you do that?

RD: I like to use the phrase 'consciousness-raising'. I don't want to be dictatorial and say there should be a law against illogical thinking. I'm not that fascist! But —

NDT: You know what would happen, if you ... let's imagine a future where all illogical people had to move to one particular state. That would be the state where all

the music and art would come from, right? All the truly creative people are some of the least logical people I've ever met, yet they create and they make the world a little more interesting. But that's a different issue. OK, so what do you do? You want to consciousness-raise. Do you have tactics? Because I want to consciousness-raise too. So let's compare.

RD: OK. I suspect your tactics may be better than mine because your tactics, I think, are to lead by example.

NDT: Yes.

RD: Well, mine are to practise logic, practise science, expose the wonder of science. I like to do all that as well.

NDT: In fact, your book has the word 'wonder' in it. Your memoir – *An Appetite for Wonder*, which any scientist has and most people have, I think.

RD: Yes, and it's actually the subtitle of another of my books, *Unweaving the Rainbow* – the subtitle is *science, delusion and the appetite for wonder*. And that book, by the way, *Unweaving the Rainbow*, is my attempt to join poetry to science. The phrase, the title, comes from Keats's attack on Newton for unweaving the rainbow. Keats thought that Newton was destroying the poetry of the rainbow by explaining the spectrum. And the message of my book is that you don't: that by destroying the mystery you increase the poetry, you don't decrease it.

NDT: And I try to go there in all of my work. Whether or not I succeed, that's my intent. So where do you differ from this? Or where else do you go?

RD: I certainly want to go all the way with that. I'm with Richard Feynman, who said, 'When I look at a rose, I see the same beauty as a poet or a painter sees in the rose, but I also get poetic inspiration from the fact that I know that the colour is to attract insects and that's come about by natural selection.'

NDT: I feel the same way about beautiful sunsets. I think there's no more reproduced image when people want you to think of God, than a sunset with beams of light coming out.

RD: Impurities in the—

NDT: —in the atmosphere! So I too ... I deeply appreciate the splendour of a magnificent sunset with a curtain of twilight colours going from, you know, deep blue to sky blue and the red sun. But I also know that the surface of the sun is six thousand degrees and is really scattering the atmosphere, you have water droplets condensing to make clouds and so I agree with the Feynman approach to that. But where else do you go, where else do you take this?

RD: Maybe I go a little bit further in the direction of good-natured ridicule, of absurd ideas like astrology, like homeopathy.

NDT: You're saying it's good-natured, but the people who are on the other side of your wit and intelligence ... are they saying you're being good-natured?

RD: Possibly not. I don't really care about that. I have an eye to – not just to the astrologers I'm talking to, but for example the radio audience or whoever it is who are listening in.

NDT: Yes, the larger ... because, right, you have visible platforms where you share this.

RD: We both do. And the point has often been made to me that if you call somebody an idiot you're not going to change his mind, and that's possibly true, but you may change the minds of a thousand people listening in and so I'm less inhibited about calling him an idiot.

NDT: OK, so when you have the conversation with the individual, knowing you have a platform, even if the individual is insulted or feels bad or feels stupid, you're relying on the fact that there are some other people who are perhaps on the fence who could be swayed by your arguments? So for me, I'm more for the one-on-one, I guess. I want to have the one-on-one conversation and the eavesdroppers are perhaps imagining themselves there. And that's my tactic, if I can call it that – I'm feeling the one-on-one more than I'm feeling the audience.

RD: You have a huge audience.

NDT: Can I give an example? How would you have handled this case? I have a relative, right, whose father died. He's my cousin, she's my niece, once removed. She's alone in the room with her father. The father is dead in a half-open casket. She reports to me – this is weeks later – and by the way, she's a real estate agent, and majored in accounting. She said her father sat up, and she had a conversation with him. And I said, 'What transpired?' and she said, 'He said, "Don't worry, I'm in a better place,"' and she said, "I'm glad, we're sad you're gone but I'm glad to hear."' And so that was the conversation. So I said, 'OK, how am I going to deal with this? This is family, how am I going to handle this?' Here's what I did. I said, 'Next time this happens, ask him questions that could be really useful on this side of that barrier, like "Where are you? Are you wearing clothes? Where did you get the clothes? Is there money where you are? What's the weather like? Who else is there? How old are you there? In your mind's eye are you young, or are you old? Is grandma there? How old is she? If grandma's where she is, would she make herself old? Or would she be young again?" Ask questions.'

RD: I think that's a terrific answer.[fn1]

NDT: Where you get information. And so now she's on notice. Every time I see her, she says, 'I got it, we're going to go there.' And so now she's got her own little experiment that she's going to do, next time dead people sit up and talk to her. So what would you – if I could just ask – what would you have done?

RD: I wouldn't have thought of that – I wish I had. I am genuinely curious – I mean, do you think she was lying? Do you think she had a hallucination?

NDT: Oh, I don't know. I mean, I'm a trained astrophysicist, so my first explanation is that it was a hallucination, because everything we know about dead people tells us they don't sit up and have a conversation, and of course there are no witnesses or video. But I didn't care whether – how real she thought it was. What I cared was that I gave her tools, I think; I gave her tools so that next time this happens, she can separate an objective reality from what might have been in her mind. And then she arrives at that conclusion by herself, not by me telling her she's hallucinating.

RD: Yes, I think that's terrific. I mean if she was still ... grieving, and still mourning, then I would have been inhibited in saying, 'You were hallucinating.'

NDT: Out of sensitivity.

RD: Yes, out of sensitivity.

NDT: So there is a soft side to Richard Dawkins.

RD: Oh, surely.

NDT: Let the record show – Richard – he can be a puppy!

RD: But setting that aside, I think I would say something like, 'I think you probably drifted off to sleep and had a dream,' something like that.

as many as a third of practising, publishing scientists would claim to be religious in the unambiguous way where you ask, 'Do you pray? Do you have an all-powerful being interceding in your daily affairs?' And they'd say 'Yes'. So you can't then say being religious is in and of itself the problem; you would have to modify that argument to say it's when you want to do *this* with your religion, then it's a problem. But otherwise, for all these other people, it's just fine.

RD: OK, let me take that point. First, I think we ought to make a big distinction between the historical point and the present day.

NDT: Sure, I conflated them. I'm sorry.

RD: Newton, Galileo ... pre-Darwin. You couldn't *not* be religious pre-Darwin – at least, you could, but you would have to be very – very stalwart in your scepticism. Because when I look around the world, it kind of looks almost obvious that there had to be a designer until Darwin came along. Who can blame Newton and Galileo? So I'm deeply unimpressed by that argument. As for the one-third of scientists in America – that's approximately correct by the polls that I've seen. But if you move away from scientists generally to the elite scientists – studies have been done of both the American National Academy and the British Commonwealth Royal Society, the corresponding elite academies of science, and there it's about 10 per cent. Now, I've seen you make the point that we still have to worry about 10 per cent—

NDT: Well, I don't know if you can use the word 'worry': that was how people wanted to characterize me, but my actual point was that we have people such as yourself out there, you know, making the case to the public – but I don't see you making the case to the third of scientists, our professional brethren; and what hope do you have of converting the public, leading them to more rational ways, when our own scientific community is representing in just that way to the level of a third – and even in the elite group, that 10 per cent is not 0 per cent.

RD: That's right. But you have to put a little bit of caution on that. If you ask the scientists what they actually believe, they may say they're religious, they may say 'I'm Jewish' or 'I'm Christian'. If you actually ask them, the one-third, and perhaps more particularly the 10 per cent, what they believe, they will talk about the mystery of the universe – they have a sort of reverent attitude, which I have as well and I think you have. But then if you say, 'Do you actually believe in anything supernatural? I know you call yourself Christian, but do you believe that Jesus was born of a virgin and rose from the dead?', of course they don't. And so, you've got to subtract them off, I suspect; you subtract off the Einsteinians—

NDT: So the Einsteinian God is Spinoza's God, a God of the universe that is responsible for laws and things and responsible for the universe that science observes. It's just kind of untestable, that's all.

RD: I don't think it would even be 'responsible for the universe'; I think it's just God *is* the universe. Which is a bit different from thinking there's an intelligence that started it all. So I think you want to subtract them off. And then you are left with a few who actually do believe in the virgin birth, and I don't know what to make of them. I think that they are, as it were, traitors to science.

NDT: But they still do science! So you object philosophically.

RD: Like the astrophysicist I told you about. Well, we've been there already. But there's something else perhaps I'll tell you. My British foundation did a survey – we commissioned a public opinion poll – and we chose the very week of the census which took place in 2011, and the census in Britain actually asks what

your religion is and you have to tick a box that says Christian, Jewish, Muslim etc. or none. So we commissioned a professional polling organization to sample those who ticked the Christian box to find out what they really believed. Obviously it was only a sample, it was a couple of thousand, but it was done professionally. And we asked them questions like 'OK, you ticked the Christian box, do you believe Jesus is your lord and saviour?' No. 'Do you believe Jesus was born of a virgin?' No. 'Do you believe Jesus rose from the dead?' No. 'Then why do you call yourself a Christian?' Oh, because I like to think of myself as a good person. So that's the kind of level that people will sink to in agreeing to tick the Christian box to get the label, to accept the label of Christian. We then said well, OK, so you like to think of yourself as a good person – it wasn't sequential, they're all separate questions – but you like to think of yourself as a good person; so when you're faced with a moral dilemma in your own life, do you turn to your religion, or do you turn to your friends? Do you turn to your cultural background?

NDT: It's an excellent question. Beautiful question. I want to comment on that, but go on.

RD: And I think it was only about 9 per cent of people who ticked the Christian box who said they turn to their religion, although a majority said that they ticked the Christian box because they like to think of themselves as a good person. So all this is showing really is: be sceptical when people tell you that they are religious. Be sceptical when people tell you 'I am a Christian' or 'I am a Jew', especially if they say 'I'm a Jew'. That probably means that they are loyal to Jewish traditions and—

NDT: In America, generally, it means just that. Unless they're full-out Hasidic, practising. Judaism is a culture, more than it is a religion, here in the United States.

RD: Which is fine.

NDT: I was interviewed for the *New Yorker* magazine and at some point the interviewer asked, was I raised in any religion? I said yes, I was raised Catholic, and that was actually the first time I had ever said that publicly. I never tried to hide it, it was just that no one ever asked. And I said, but it was kind of like we used to go to church weekly and then it kind of faded to once a month, then we became 'Ashes and Palms' Catholics where you just go on the holidays – and of course we celebrated Christmas. And the real point I wanted to make in this article was that it did not influence, in any obvious way, any decisions we made; my mother never came to us and said, 'You shouldn't do this because Jesus is watching.' There was no such interaction in the household. But there was the urge to say, in an article on Neil deGrasse Tyson, 'He was Catholic but now he's a scientist and lost his Catholic ways,' as though there was some big transition that happened.

RD: But there was no transition.

NDT: There was no transition! I see the urge of people to want to make these associations, but in our household there was never the thought, 'What would Jesus do?' Just: 'What would a rational, thinking person do in this situation?' And that's how my whole life unfolded.

I still would rather just have no label at all. The only 'ist' I am, as I've said, is a scientist, and beyond that – have a conversation with me, as we just did!

So Richard, thanks for coming through town. This is a long overdue conversation.

RD: Yes.

NDT: Every time I see you I say, you know, 'I want to tell him this', and 'I want to think about that', and get his take on this – so it was great to have you here. So thanks again.

RD: And thank you!


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