

the possibility of evolution and the transmutation of species. And from this idea sprang natural selection. It is illuminating and convincing to see how Darwin, in his intellectual maturing, changed from intelligent design to evolution.

*Intelligent Thought* is a book for scientists;

that is, for those who see evolutionary biology as a science. If you are a creationist you will be unmoved; there is no point in looking at the evidence. ■

John Tyler Bonner is in the Department of Ecology and Evolutionary Biology, Princeton University, Princeton, New Jersey 08544, USA.

## Diary of a weed

### Seed to Seed: The Secret Life of Plants

by Nicholas Harberd

Bloomsbury: 2006. 320 pp. £16.99, \$24.95

### Anthony Trewavas

Diaries are objects of intense fascination. Not only do they provide unique insight into the private thoughts and attitudes of the author, rarely conveyed by autobiography, but they can become important historical documents. Famous diarists such as Samuel Pepys in the seventeenth century and John Colville during the Second World War described the intimate workings of British government during periods of enormous social upheaval and war. Others, like the British politician Alan Clark, who consigned to their diary assessments of their political peers they would never voice in public, provide highly entertaining reading.

Diaries by working scientists are rare, so with the above thoughts in mind, I welcomed the chance to read Nick Harberd's contribution to the genre. Harberd is a plant molecular geneticist at the John Innes Institute in Norwich, and kept 'jottings' throughout 2004. Apart from the inevitable descriptions of seasonal changes in weather and wildlife and outlines of conversations with his two children, it slowly becomes apparent that the real subject of this diary is *Arabidopsis*, a weed with a very short life cycle (seed-to-seed) of some 4–6 weeks. These characteristics have made it the plant of choice for an enormous amount of gene identification and developmental analysis. Harberd uses the diary as a vehicle both to describe simple aspects of plant development and to structure his own research on *Arabidopsis* in 2004. The life cycle of a few wild specimens of *Arabidopsis* (in contrast to lab-grown versions) is also lovingly described — it ends when they provide a first-class meal for some roaming slugs!

Harberd records the thoughts, guesses, assessments, excitement, obsessions, publication problems and productive experiments that are the meat and drink of any experimental scientist. His significant achievement of 2004 was the identification and sequencing of the crucial *rht* (reduced height) gene. The 'green revolution' of the 1960s and 1970s resulted from the introduction of this gene into wheat and rice by Norman Borlaug. The resulting dwarf cereals had grain yields more than three times greater than their parents,

and turned Mexico, China and India into net cereal exporters. An estimated 1 billion humans were saved from the savagery of slow starvation and premature death that some scientific Jeremiahs had long predicted as their inevitable fate.

The identification of this gene thus represents the final chapter in a story that vividly illustrates the value of technology in ameliorating human problems. We are technological animals. All human activities (including technology) have costs as well as benefits, but our capacity to rise to the challenge of complex problems is frankly what makes us human and makes living worthwhile. To deny this, to

deny the value of the advance of science, as some currently do, is to deny our humanity.

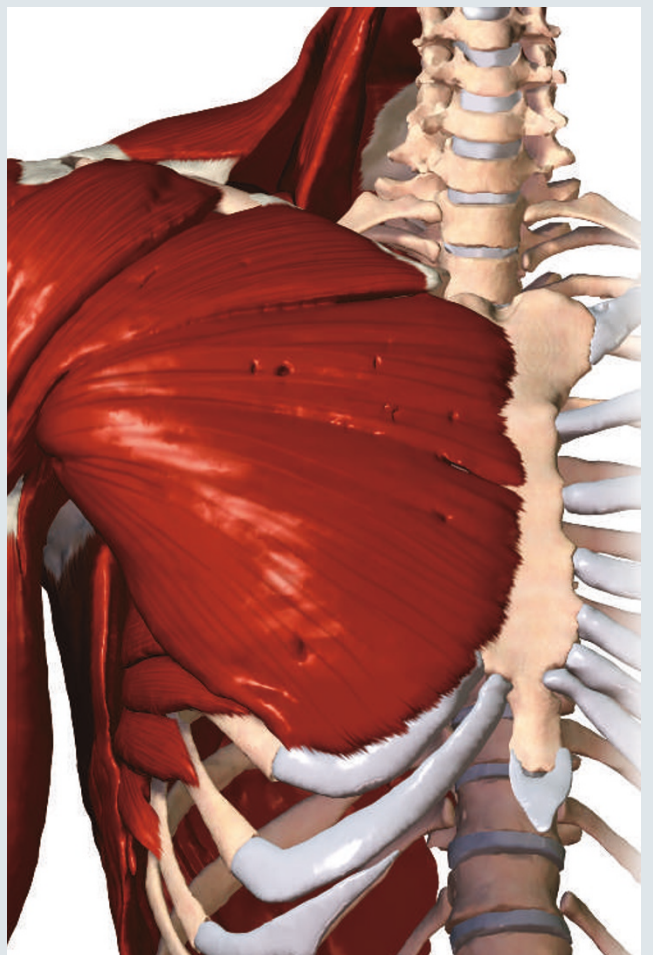
Harberd's diary makes for easy and enjoyable reading for a plant biologist like myself, but I gradually began to wonder who its wider audience might actually be. Commentaries on seasonal changes in weather and nature form the basis of many published Edwardian diaries and are often better illustrated. The introduction makes clear that the author thinks the diary is written for non-scientists, but I was left wondering who, if any, of my non-scientific friends would make sense of it all. There is enormous interest in Britain in plants of all kinds, but from a gardening and horticultural perspective only. So a diary about a weed is unlikely to gain a sympathetic readership here. Despite the author's view of his readership, I think that other non-botanical scientists are the most likely audience and that many animal scientists and microbiologists would find pleasure in learning how the other half lives and works.

So is this diary instead a charm offensive from genetics, a subject often painted as based on grim-visaged determinism? Is it the velvet glove of the intensely human diarist hiding a genetical iron fist underneath? Harberd

## The body bared

From the early Renaissance on, our drive to discover, uncover and map the unknown has found rich pickings in the human body. Laying it bare from bone to skin became a mania among medics and artists alike, starting with Leonardo da Vinci and gaining momentum with the likes of Jacopo Berengario da Carpi, Andreas Vesalius, and later William Cheselden, John Hunter and today's digital modellers.

*Human Anatomy: Depicting the Body from the Renaissance to Today* by Benjamin A. Rifkin, Michael J. Ackerman and Judy Folkenberg (Thames & Hudson, £17.95) dissects this history with elegance — and with the aid of 320 stunning illustrations that cover the gamut of styles, from Baroque surreality to the drily detached.



ponders on the general perception of science as unemotional, requiring publications that omit feelings, wonder and fascination at the complexity of life in all its ramifications in favour of bland objectivity. But in that case, it doesn't help to read that our *raison d'être* is our genes, a view I profoundly disagree with but an error commonly voiced by geneticists. Cells, organisms, tissues and populations are

all complex integrated systems; genes are part of these systems, but what makes us is the whole, not any one part.

This is not to decry Harberd's effort. Anything that reveals to the public that under the skin scientists are human like anyone else is to be welcomed; only scientific knowledge is blandly objective, but therein lies its strength. Harberd's diary is, I hope, the harbinger of

others, and should be regarded as a valuable and successful experiment. Biographies of scientists are common, but diaries containing day-to-day thoughts and speculations are far more attractive. If only Newton, Einstein or Darwin in later life had obliged. ■

Anthony Trewavas is at the Institute of Cell and Molecular Biology, Kings Buildings, University of Edinburgh, Edinburgh EH9 3JH, UK.

## Playing the numbers game

### Does Measurement Measure Up? How Numbers Reveal and Conceal the Truth

by John M. Henshaw

Johns Hopkins University Press: 2006.  
248 pp. \$26.95, £14.63

#### David Colquhoun

Now, more than ever, we are besieged by numbers, targets, league tables and non-stop auditing. We are inundated with management gobbledygook. Most of these activities produce numbers, but what do all these numbers mean? That is the question asked in John Henshaw's book *Does Measurement Measure Up*, and it is undoubtedly a timely question

The book starts by quoting Lord Kelvin: "When you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind." What scientist could doubt that? Realism soon creeps in though: "The darker side of measurement ... manifests itself in a variety of ways, perhaps nowhere more insidiously than in 'measurements of the mind'." Henshaw proceeds to take apart the ludicrous idea that a person's worth can be measured by a single number. This is a book that is intended for a wide audience, so the discussion is not very technical. Interesting stuff, such as a good discussion of the nature-nurture problem, is missing almost entirely (perhaps because the author is an engineer not a geneticist).

Henshaw's *bête noire* is the weighted mean. Nothing wrong with it, of course, when the weights have some proper basis. The problem arises when the weights are just produced from a hat to combine separate measurements into a single number. That means that you can get almost any number you want by adjusting the weights: a classical garbage-in, garbage-out problem. Henshaw illustrates this beautifully by his evaluation of the US system used to rank universities. Why give 25% weight to peer assessment and 10% to expenditure per student?

Using other weights would produce different outcomes. His account of the man who was hired by the University of Tulsa, Oklahoma, to improve its ranking is chilling, but many universities now waste money in that way.

In some ways UK university rankings are even worse. Here the rankings involve measures of teaching quality. That sounds entirely reasonable until you look at where the numbers come from. They come from the Quality Assurance Agency (QAA), an organization that costs £11.5 million (US\$21 million) annually,



I am not a number: evaluating people by numbers is often meaningless, but we still do it.

but which seems to think that the quality of teaching can be measured numerically without bothering about what is being taught. This leads to absurd results, like university courses in homeopathy (yes, there are some) being given near-perfect scores when they should really be referred to the Office of Fair Trading for describing as science a subject that is more akin to magic. The antics of the press in their attempts to rank universities are a more-or-less honest attempt to make money. The reification imposed by the QAA is an intellectual disgrace. As so often, it is a case of '*Quis custodiet ipsos custodes*'? Or possibly, a case of, 'those who can, do; those who can't, assess'.

Now back now to the book. The best bits are the discussions of IQ and of rankings. They deal, if incompletely, with the absurdities, and

the real social harm, that can come from trying to measure what is not measurable (at least by a single number). Other chapters discuss ranking in sports, and the sorts of measurement that can be made in business management, magnetic resonance imaging, the genome and global warming. These are subjects of great interest to many people, but I found their treatment disappointing. The chapter about ranking in sports will not mean much to anyone who does not avidly follow baseball results, and to follow one of the author's examples of climate measurement you have to be familiar with summer in Las Vegas. More seriously, though, there is no critical analysis of whether the measures used in business management, genetics and climate studies actually measure what they purport to. I would really like to know how much management-speak is just pretentious gobbledygook, but this book didn't tell me. Systems biology, an area in which clever computations are often based on dubious, or even non-existent, numbers, deserved a mention but doesn't get it.

The style of writing is easy, but it lacks passion. IQ advocates are gently taken to task, and journalists mildly castigated. I suspect that Henshaw lets off too easily the main villains of the piece, namely academics themselves. They (some of them, anyway) provide the box-ticking and paper-collecting for agencies such as the QAA. It is not unknown for some of us to exaggerate the significance of our findings, partly, of course, because of fear of the next Research Assessment (yet another case of attaching dubious numbers to complex activities). And as they get older, too many academics seem happy to take refuge behind a façade of management-speak in the style so beautifully described by Michael O'Donnell in his *A Sceptic's Medical Dictionary* (BMJ Books, 1997) as "decorated municipal gothic".

Numbers, as Henshaw's book says, are often abused, but it is academics who must shoulder much of the blame for that. ■

David Colquhoun is in the Department of Pharmacology, Gower Street, University College, London WC1E 6BT, UK.