are not impregnable island fortresses entire unto themselves, but networks of communication: they reach out to the world and ask to be transformed by it.

Scientists have no reason to panic at the thought that science is an element in human culture alongside many others. Science is not about to be marginalized or engulfed, as European magic and witchcraft were 300 years ago. Scientists may exasperate their cultural neighbours by constantly shouting abuse at "relativists" and beating on the drum of "objective truth", but on the whole they still have the public's approval. What should really worry us is that science is still being used — perhaps now more than ever — as a means of cultural exclusion, dividing the world into scientific haves and have-nots. It urgently needs to make itself more welcoming to strangers, so as to become a part not only of our own culture, but of culture "for all people". Sanctimonious, defensive sarcasm can only make matters worse. □

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Wondrous correctness

Unweaving the Rainbow
by Richard Dawkins
Penguin: 1998. 313 pp. £20, $26

Gillian Beer

This volume falls, somewhat prematurely we may hope, into the Grand Old Man genre. Richard Dawkins lards his enthusiastic tribute to the wonders of science with quirky asides and personal anecdotes. These anecdotes assume the reader's affection for him, always a risky assumption before reaching admired and advanced old age. His conversational style allows him to be brusque and testy about others' achievements and expect to carry the reader with him.

The argument of the book is unobjectionable: that understanding the processes revealed by scientific analysis makes things more wonderful, not less. Emphasizing the Wonders of Science has been a staple of scientific popularization for the past 200 years. Science makes strange the familiar and thus opens our eyes to the intricacy and the extent of the world within which we bumble along from day to day. Dawkins makes a further turn on this argument to distinguish between 'good' and 'bad' wonder. He attacks credulity and its manifestations "in superstition, the paranormal, and astrology".

John Tyndall undertook a similar epistemological joust, more amusingly described; invited to attend a seance 100 years ago, and fresh from his Royal Institution demonstrations, he competed with his spiritualist hosts: "The wonderful narratives resumed; but I had narratives of my own quite as wonderful. These spirits, indeed, seemed clumsy creations, compared with those with which my own work had made me familiar. I therefore began to match the wonders related to me with other wonders. A lady present discoursed on spiritual atmospheres, which she could see as beautiful colours when she closed her eyes. I professed myself able to see similar colours, and, more than that, to be able to see the interior of my own eyes. The medium spoke of the performances of the spirits on musical instruments. I said that such a performance was gross, in comparison with a kind of music that had been discovered some time previously by a scientific man. Standing at a distance of twenty feet from a jet of gas, he could command the flame to emit a melodious note…. These were acknowledged to be as great marvels as any of those of spiritdom. The spirits were then consulted, and I was pronounced to be a first-class medium."

Tyndall recognizes with wry humour how readily scientific assertion can be absorbed back into contrary beliefs. Dawkins takes that argument in a different direction. He enlarges his attack on credulity to include what he sees as falsely ethical readings of evolution in the work of Stephen Jay Gould and in followers of James Lovelock. He offers, as an alternative, clear and approving accounts of the work of scientists such as Horace Barlow and Richard Gregory, who have paid special attention to vision and its determinants.

The book is at its best in those chapters and passages where Dawkins can delight in exposition; he writes effectively on genes and their histories, and on the brain and its modelling powers. Sometimes, however, the chapters seem to be patched together from paragraphs and *aperçus* laid end to end without a defining thread of argument. Dawkins seems at times uncertain of the audience he is addressing (we are assumed to be knowing enough to share his prejudices against quite sophisticated critical theorists and yet to need educating about coincidences). Sometimes he denounces metaphor, and sometimes breezily adopts it. He has clearly been stung by the critiques of his own metaphoric habits in *The Selfish Gene* with its shift of levels from activity to ethics, for he alludes more than once to the need to read the whole book and not be misled by its title.

Unweaving the Rainbow is at its worst in the often impatient and cavalier treatment of evidence from intellectual fields outside science. This ranges from a demeaning reference to John Ruskin, and a simplistic aside concerning the cultural anthropologists Margaret Mead and Derek Freeman, to a condescending habit of wresting a line from a poem to serve his purpose, as if it had no further complexity or context. So, a fine quotation from the astrophysicist Subrahmanyan Chandrasekhar is pitted against "Beauty is Truth, Truth Beauty" as sounding "much more sincere".

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Lamia: woman or serpent? The fruits of scientific enquiry may not always be pleasing to the eye.

Dawkins accuses his avowedly favourite poets, Keats and Yeats, of typifying an ignorant repudiation of science. If only Keats had turned to Sir Isaac Newton for inspiration, if only Yeats had accorded more value to reason, how much better their poetry would be! The title of his study draws on Keats's poem "Lamia", which is concerned with the peculiarly equivocal appearances of things. Lamia is a woman but she is also a destructive serpent; in both incarnations, however, she is very beautiful. As a serpent she is:

A gordian shape of dazzling hue,
Vermilion-spotted, golden, green and blue,
Striped like a zebra, freckled like a pard,
Eyed like a peacock, and all crimson barr'd

Which is her true nature? Is she, as she claims, an innocent woman bewitched, or is she a guileful serpent disguised? The old sophist Apollonius blasts her with his philosophic gaze and she resolves into a serpent, but she is no longer the beauty of before, now she withers away.

The vigour of Keats's language thrives on precise detail. The poem struggles, with poignant sophistication, to interpret the cost of pursuing knowledge. It works to disabuse the reader from any idealized fancy that beauty will always be rediscovered at the end of enquiry. Keats had begun training as a

medical student and understood these issues without sentimentality.

Dawkins wants it both ways. He wants to function as Apollonius, disabusing his reader of the various magical-seeming possibilities of astrology, coincidence, relativism and misleading metaphor. But he also wants to assert the inevitably wonder-enhancing power of scientific insight; he does not want to destroy the beauty of Lamia. He is dismayed by the poet's question:

Do not all charms fly
At the mere touch of cold philosophy?
There was an awful rainbow once in heaven:
We know her woof, her texture; she is given
In the dull catalogue of common things

In "Lamia" the question is loaded with the dismay of the poet struggling to locate truth. "Lamia" is no ignorant rejection of natural philosophy's reductionism; it is a painful and sinewy debate, more tough-minded than the softened prose in which Dawkins ends *Unweaving the Rainbow*: "A Keats and a Newton, listening to each other, might hear the galaxies sing". Or, as Keats recognized, the galaxies may not be singing. □

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The unread menace

Measuring Minds: Henry Herbert Goddard and the Origins of American Intelligence Testing
edited by Leila Zenderland
Cambridge University Press: 1998. 448 pp. £45, $64.95

Roy Porter

Henry Herbert Goddard won a somewhat dubious immortality by coming up with the term 'moron' — meant to identify from among the mass of the 'feeble-minded' a "person of attested mental development with an intelligence comparable to that of the normal child between 8 and 12 years inclusive". From such a coinage, there is much that could be easily — and correctly — predicted about the convictions and career of one of the most influential US psychologists of the first half of this century (he died in 1957 at the ripe old age of 91). Goddard, as one might guess, was one of the vociferous cohort of scientists preoccupied with human 'degeneration' and seeking ways of averting the 'threat' posed by 'defectives' to American society.

But, as Leila Zenderland demonstrates in a well-researched if somewhat hefty biography, Goddard, although a keen eugenist, resists being reduced to the reactionary eugenist villain who looms large in recent historiography. After all, he thought of his politics as being progressive — he even favoured the New Deal — and he was opposed to the more extreme measures (such as the 'lethal chamber') being touted to deal with the 'menace', and even rather doubtful about the desirability of surgical sterilization.

Goddard, who around the time of the First World War was America's most widely-read psychologist, saw his career in terms of chance and happenstance, and there is an element of truth in that view. Born in 1866 into a typically pious New England Quaker family, he attended a minor college (Haverford) and drifted around for a while on the fringes of higher education until, like so many others of his generation, he was fired by G. Stanley Hall of Clark University in Massachusetts. It was Hall who persuaded Freud to make his one and only trip to the United States. In Hall's inspiring vision, the up-and-coming discipline of evolutionary psychology was destined, in effect, to replace religion. It would bestow on society a body of scientific values suitable for combating the ills of modern times and grant to individuals a means to self-awareness and self-improvement. Goddard was converted.

Convinced that the 'unfit' constituted not only a pressing problem but a group on whom he could practise his new-found professional expertise, Goddard took employment in 1906 in a 'training school' for the 'feeble-minded' — Vineland, in rural New Jersey. Two years later, while travelling in Europe, he had the good fortune to be one of the first to grasp the significance of the intelligence tests newly developed by Alfred Binet, which launched the concept of 'mental age' within the framework of a general mental test.

The 'feeble-minded' underclass: these 'cases' of Goddard's were said to have a mental age of seven.

Confusion had long reigned when it came to the tricky matter of classifying the different grades of 'idiots', to say nothing of disputes — between doctors, educationists and institutional superintendents — as to the cause and proper treatment of the condition. An energetic member of the 'Feeble-Minded Club', Goddard was able to persuade first himself and then his colleagues that the Binet test — that is, a psychological approach — would provide solutions as to what should be done with these problem people.

Like many of his ilk who were, by training, pedagogues rather than physicians, Goddard was initially optimistic about what could be achieved: the 'feeble-minded' would prove educable, leading to "a better mind if not a perfect mind", if only one researched the right way to go about it. But bitter experience seemed to prove the opposite. And so his thinking underwent a sea-change, from a position not unsympathethic to the contribution of the environment ('nurture') in producing and rectifying defectives, to one that insisted on the cardinal role played by heredity ('nature').

Familiarizing himself with Mendelian genetics, Goddard began to investigate the family backgrounds of institutional populations and professed surprise on finding a vast submerged iceberg of imbecilism. Degeneracy evidently ran in families, and marriages between epileptics, alcoholics, criminals, syphilitics, nymphomaniacs and all other "defectives, dependants and delinquents" only served to make bad worse down the generations. The defectives were not only different; they might even constitute a 'moron majority'.

These findings were written up in 1912 in a book that became a bestseller: *The Kallikak Family: A Study in the Heredity of Feeble-Mindedness*. The name was fictitious (it is a compound of the Greek words for beautiful and bad), but the family was real. Goddard had traced its bifurcated pedigree (some 480 descendants) from its eighteenth-century roots. One branch was thoroughly respectable, while the other (descended from the first Kallikak's illegitimate offspring) engendered a succession of defectives, criminals, prostitutes and so forth. The book entered the culture, and it even achieved a reprint in Nazi Germany. A more conventional statement of his research findings then appeared in *Feeble-Mindedness: Its Causes and Consequences*, published in 1914.

The rest of Goddard's lengthy career was dedicated to further exposure of such undesirables and to the application of psychometric testing to all walks of life — from immigration controls to the army — in the belief that intelligence differentials were crucial to the understanding and resolution of social problems.

In Goddard's eyes, 'the facts' had thus