The mischief maker

J.O. Marsh

The Demon in the Aether: The Story of James Clerk Maxwell.

By Martin Goldman.

Paul Harris, 40 York Place, Edinburgh: 1983. Pp.224. £18.

JAMES Clerk Maxwell was more an imp in the underdrawings than a demon in the aether. True, his mischievous activity so undermined classical physics as to bring it to ruins, but that was not until 30 years after his death. Demon or imp, Maxwell remains an insubstantial figure behind the pages of Goldman's biography.

The facts of Maxwell's life have been established by other scholars. His father devoted most of his married life to developing and improving the family estate, Glenlair in Galloway. James, the only surviving child of the marriage, was educated by his mother until, when he was eight, she died. His father continued the schooling initially by having James assist him with his improvement schemes and later by employing a tutor. The tutor was a disaster and, at the age of ten, James was sent to live with his aunts so that he could attend the Edinburgh Academy. There he made two lifelong friends, Lewis Campbell and Peter Guthrie Tait, and gained the nickname "Dafty".

After six years of learning classics at the Academy, Maxwell entered Edinburgh University. He remained there for three years (perhaps to stay near his father), studying mathematics under Phillip Kelland, philosophy under William Hamilton (not the Irish mathematician) and natural philosophy under James Forbes. Then on to Cambridge and the "Public Service" examination, the maths tripos. He was second in the tripos to Routh but equal first with him in the unofficial physics examination, the Smith's prize.

After Cambridge, Maxwell's career was spectacular only by his early death. He spent two years as Scholar and then Fellow of Trinity College, four years as Professor of Natural Philosophy at Marischal College, Aberdeen, five years at King's College, London, and then six years retirement at Glenlair (completing his father's schemes on a considerably reduced scale). He failed in an application to become Principal of St Andrews in 1868 and was third choice to direct the new Cavendish Laboratory at Cambridge. However, the two preferred candidates (Kelvin and Helmholtz) declined and Maxwell was appointed Cavendish Professor of Experimental Physics in 1871. He died of stomach cancer eight years later.

Maxwell's official biography was written by his Academy friend, Lewis Campbell, and his Cavendish Laboratory assistant, William Garnett, and first published in 1882. This six-hundred page classic of Vic-

torian sentimental hagiography is the main source for the ten biographical chapters of Goldman's book. By cutting extensive quotations to "juicy" paragraphs, by adding a bit of gossip about Maxwell's wife and by suggesting that Maxwell's religious belief was conventional "religiosity", Goldman presents Campbell and Garnett's Maxwell suitably repackaged for our modern Victorian age.

In the 1882 biography, William Garnett described Maxwell's scientific contributions under seven headings: experiments on colour vision and other contributions to optics; investigations respecting elastic solids; pure geometry; mechanics; Saturn's Rings; Faraday's lines of force and Maxwell's theory of the electromagnetic field; and molecular physics. Garnett stated that his contemporaries judged the latter two as most important and in this posterity has shown them to be correct, though not in the way they might have expected. Maxwell's electromagnetic theory led directly (not via the Michelson-Morley experiment) to Einstein's theory of special relativity, and his molecular physics (dynamical theory of gases) led to statistical physics and quantum mechanics.

Goldman devotes four chapters to Maxwell's scientific work: one each to the dynamical theory of gases and electromagnetic theory, one to the revolutionary consequences of these theories and one to the rest of Maxwell's scientific work. Apart from the latter, which is little more than the catalogue above, each of these accounts is

seriously flawed. So, in the chapter on the dynamical theory, Goldman claims that the analytical methods of Fourier are "an abstract mathematical technique, far from the geometrical methods 'normally' associated with Maxwell" (p.110). This is nonsense. Part of Maxwell's genius lay in his ability to switch from geometrical to analytical methods and back, and this he did frequently and to great effect.

In the chapter on electromagnetism, Goldman states "It seems quite remarkable that Maxwell's book, which even today is a model of precision and clarity, should have appeared murky and impenetrable to his contemporaries" (p.159). Three pages later Goldman himself identifies the great problem with Maxwell's theory: "Underlying the whole theory was the basic ambiguity of the nature of charge" (p.163).

Goldman is either unaware of, or has ignored, the work published over the past ten years of at least a dozen scholars. Attention to that literature might have helped him avoid many errors, but I doubt if anything would have deflected him from the triteness of his conclusions:

As a boy he electroplated beetles and played marbles ('bools') as a man he unified electromagnetism and founded statistical mechanics. There is a wholeness in the circularity and immutability of his interests [p.195]. □

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Public knowledge

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Aristotle to Zoos: A Philosophical Dictionary of Biology.

By P.B. and J.S. Medawar.

Weidenfeld & Nicolson/Harvard University Press: 1984. Pp.305. £15, \$18.50.

IT IS necessary only to open the Sunday papers to discover that the educated man in the street has recently adopted biology as a topic for generalized opinion and discussion. It is hardly surprising that biology should be the first science whose basic concepts enjoy universal currency. Biology alone among the sciences has been taught to all schoolchildren in the Western world for over a generation. The primitive traditions underlying the organization of schools have been allowed to deny most girls a proper education in mathematics and the physical sciences. As the girls and the physical sciences have lost from this mad policy, so biology has gained. Minds cultivated in biology are now as common among women as among men. In the biological sciences it is therefore no surprise, only a pleasure, to find a husband and wife sharing the writing of a book, and it is

especially apt that the book should be a work intended to enlighten still further the biologically literate general public.

Aristotle to Zoos is an odd book. Ostensibly based on Voltaire's *Philosophical Dictionary*, the Medawars have used the format as an excuse to write as much or as little as they wanted on whatever biological topics they fancied. This is, of course, a recipe for self-indulgence, and the book is not entirely free from this vice. Turning to the entry on Aristotle, for example, the startled reader discovers that for some reason the Medawars have it in for the old boy in a big way, quirkily preferring Coleridge as a superior alternative, and muttering about monkeys on a typewriter. I suspect that Sir Peter Medawar may have allowed his distaste for authors who write too much to get the better of his critical judgement. I remember a masterly Herbert Spencer Lecture given by Medawar in Oxford some years ago. Medawar had borrowed Spencer's gigantic *System of Philosophy* from the Royal Society library and transported it to the lecture theatre in Oxford in order to illustrate his gleeful pronouncement that he himself had been obliged to cut the pages. His disparaging view of Spencer was shared by the Dean of Westminster, who noted in 1904, while denying a request to bury Spencer in the Abbey,

"when I ask with what important achievement in philosophy or in natural science, or with what permanent contribution to thought his name is destined to be connected, I meet with no satisfactory reply". At face value, this seems to be alarmingly close to the Medawars' view of Aristotle!

Experienced Medawar readers will recognize that a good deal of the serious matter of the dictionary represents Sir Peter's scientific preoccupations of many years standing — demography, growth and form, the immune system and so on. These little essays are beautifully written, trenchant, witty and informative. They are also so erratic in level as to provoke me into articulating the question I had vowed, before writing this review, not to ask. For whom are these essays written? For example, "Growth, Laws of Biological" has a full-page table giving the equations and analytical properties of three growth functions, while "Population, Growth and Control" has a little box showing what an exponential series is. It probably doesn't matter. After all if some of the subject matter of biology lends itself to elegant mathematical treatment, then why should not the numerate man in the street be given the pleasure of enjoying it?

In the same context, an odd feature of the book is the evidence that its authors do not have a particularly high regard for the intellectual pretensions of the very members of the lay public who must be expected to buy it in largest numbers. Twice this group is identified as that to which the structural formula of water represents the upper limit of scientific knowledge. I do not trust this attitude. Who knows how the lay public, deprived of precise understanding, perceives science? What is certain is that it does not want to have its head bitten off by the Medawars because it knows only that H_2O is water, or because it does not yet know that man is not an aggressive animal, or that you can't change human nature. It does not help to be told merely that "educated people do not have to refer to ethological papers before rebutting these trite propositions. Indeed, such phrases are now almost universally taken to mark an especially low

level in conversation or discussion". I can only suppose that these strictures are intended to frighten the ignoramus into silence.

But it is best not to worry, and rather enjoy the lovely prose and the tough precise intelligence. This is not the place to hunt for oncogenes, homeotic mutants or other heroic manifestations of the trend end of modern molecular biology. Rather, *Aristotle to Zoos* is more like a guided tour through an antiquary's collection of unusual, funny, embarrassing or lovely things chosen for their intrinsic interest or on a whim rather than for topicality or information alone. In Voltaire's *Dictionary* the whimsical titles and strange oblique manner were the disguises of a robust and effective attack on the hypocrisy, intellectual poverty and temporal tyranny of the Catholic Church. If a central informing theme is to be found in the Medawars' dictionary, it is an appeal for a disciplined and critical mind.

A final comment, suggested appropriately by the essay on zoos. Experimental biologists are often called on to abuse animals in the course of their work. These abuses are both sanctioned and limited by the laws which cover cruelty to animals. It is important to realize that, in Britain, the Cruelty to Animals Act (1876) is explicitly intended to *permit* cruelty to animals. Without a doubt, this licensed cruelty to animals takes its toll on the scientist's sensibilities, on his ability to judge the consequences of his experiment by what one might call "normal" humane standards. Just because our animal experimentation is regulated by law, and law which is necessarily diffuse and imprecise in application, it is difficult for the scientist to retain a sense of primary obligation to the animal rather than to the law or to the experiment. Both in "Zoos", and more explicitly in the superbly judged and eloquent essay "Animals and Human Obligations", the Medawars show that they have managed, after a lifetime in experimental biology, to keep their sensibilities intact. □

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Thoughts from the High Table

Steven Rose

The Synergism Hypothesis: A Theory of Progressive Evolution.

By Peter A. Corning.

Blond & Briggs/McGraw-Hill: 1983.

Pp.492. Hbk £15, \$19.95;

pbk \$12.95.

CONFRONTING the ultimate question, the secret of life, the universe and everything, that well-known text *A Hitchhiker's Guide to the Galaxy* responds simply "42". Dr Corning's response is *The Synergism Hypothesis* but, unlike the *Guide*, he takes a full 492 pages of eclectic and autodidactic argument to expound a thesis which he claims embraces everything from biological evolution to how to run hospitals in California, taking in *en route* cost-benefit analyses of the relative merits of the political systems of Iran and Mexico, and cooperative phenomena in the synthesis of proteins. It is at once evident that in *The Synergism Hypothesis* we are confronted with a book that its author and publishers wish us to see as a Great Event. Faced with such a range of subject matter and an author who we are told is "one of the pioneers in applying a biological perspective to the social sciences" how is a poor Cambridge empiricist like the present reviewer, constrained to crawling along the frontiers of knowledge with a hand-lens, and taught to eschew Grand Theory, to cope?

Dr Corning, as we might imagine, has few doubts as to the importance of what he has achieved — "like Darwin's theory, properly understood, my theory makes only one unequivocal prediction", he informs us with no false modesty (p.392). One's sense of awe is only slightly quenched to read on as follows: "that the future cannot be predicted with certainty because the process is not linear or deterministic . . .". Well yes, but Darwin had just a little more to say than that, or we would not still be reading him today. Dr Corning, however, sees himself firmly seated at High Table with the intellectual giants of the past 2,500 years, praising Plato and Durkheim here, criticizing Marx and Darwin there, mapping his own ideological descent with a scent-marking of faint acclaims and sharp disapprovals.

So what is the Synergism Hypothesis? "Functional synergism is so much a part of our daily lives that we generally take it for granted" (p.228). Well, thanks. But is it new? "Plato and Aristotle understood the synergism principle; so did Adam Smith" (p.229). So why do we read Dr Corning? To tell us that we can see synergism at work when we "Imagine a scissors with only one blade, a tweezers with one claw . . . a broken drinking glass . . . an electric appli-

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