both equally alive to the crisis-ridden state of the modern world and the state of modern science, their search for coherent meaning leads them to fuse these two realms into a world-view in which they are inextricably interdependent. Theirs is one interpretation of the past course of history and its possible future trend, but in the light of their own words they are honour-bound to admit that it is a subjective interpretation and that others are possible. One cannot take exception to their yearning for a better world nor to their description of the development of science. But there are good reasons to regard the link between them as not established. Human ingenuity in creating untold misery did not wait for the development of a mechanistic world-view. When Rome burned while Nero fiddled, when under-occupied soldiers in the fourteenth century turned brigands and plundered, raped and burned the French peasantry, devastating its agriculture, very different world-views prevailed. The holistic world-views that have for thousands of years dominated thought in the Far East have not avoided hunger, violence and overpopulation, nor the Cultural Revolution. Furthermore, the assumption that for the period with which these books deal one world-view permeated societies is questionable. People did not and do not regard themselves as machines, notwithstanding the existence of robots. In their search for meaning they have turned neither to Newton nor Niels Bohr, but increasingly in the United States to curious sects, pseudo-religions, creationism, blind imitation of Eastern practices, extrasensory perception, spiritual media and astrology — all of them dangerous in their thoughtlessness as Berman explicitly recognizes, but all of them nearer to the advocated world-view than to mechanistic conceptions.

If the argument is, however, that it is not the general population but those who hold political and economic power who exemplify the Newtonian system and thereby run us into destruction, one could equally well argue that their many misdeeds are the result of sharing essential ingredients of the new view: all too many political and economic pronouncements blur fact and value, object and subject, just as Capra and Berman advocate.

Thus one of the principal themes in these two books, the link between mechanistic science and the state of the world, stands on shaky grounds.

The other — holism versus reductionism — is treated by both authors somewhat more gingerly; both are too sophisticated to deny the enormous successes of the reductionist approach in science, but both argue that in science and the world at large holism should now replace it.

To the question of reductionism versus holism Douglas Hofstadter has surely provided the final answer in his marvellous Ant Fugue (*Gödel, Escher, Bach;* Harvester, 1979) with the Zen word "mu" which means: unask that question. It all depends on what one wants to know. If one is after the chemical composition of cells, holism won't do; if one wants to know how people cope with the crises of life, no reduction to physiological brain-processes will provide an answer, even though brain-processes are required in coping with life. The step from meaning to mechanism inevitably avoids the question to which an answer was originally sought. The meaningful whole is indeed different from its constituent parts and must be studied on its level, but unless the parts are properly functioning, wholes would collapse. So the parts, whether of human being, of ant colonies, of the environment or of the planetary system must be understood too.

It is true that many scientists still regard the reductionist approach as more "scientific", whatever that may mean. But the development of systems theories is already a powerful antidote to such narrow scientism; Capra and Berman furthermore quote many good minds (and some not so good) who are already grappling from a system's point of view with the central task of all scientific enterprises: to formulate significant questions and design ways to explore their implications. Whether such questions can be raised and tackled by relying on the poetic and mystical world-view of the unity of nature where everything is interdependent with everything else seems to me doubtful. The oceanic feeling of being at one with the Universe is a wonderful experience in moments of ecstasy. For the more pedestrian rational enterprise of science it must be replaced by asking questions of partial systems, small enough not to transcend the powers of the human mind.

Capra in his preface admits that with so large a scope he may have been superficial and simplistic when discussing many diverse fields of study, but he trusts that the whole of the book will be more than the sum of its parts. In contrast, this reader found many of the parts in both books informative and interesting, but the whole a bit muddled. □

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● Paul and Anne Ehrlich's *Extinction: The Causes and Consequences of the Disappearance of Species*, reviewed in last year's Autumn Books Supplement by Kenneth Mellanby (*Nature* **294**, 41; 1981), has just been published by the UK by Gollancz. The book was originally published by Random House in the United States. Price is £9.95, $15.95.

● A paperback edition of *Biological Energy Resources*, by M. Slessor and C. Lewis (reviewed in *Nature* **283**, 316; 1980), has been published by E. & F.N. Spon, price £6.95.

Genesis of belief

John Maddox

Fundamentalism and American Culture: The Shaping of Twentieth Century Evangelicalism 1870–1925. By George M. Marsden. Pp. 306. ISBN 0-19-502758-2. (Oxford University Press: 1981.) £11.50, $19.95.

LAST year's trial in Arkansas about equal time for creationism and evolution may have ended satisfactorily, but why was there in the first place a law for Judge Overton to declare unconstitutional? The wish to find out is a good reason for tackling this intricate but elegant piece of scholarship. Disappointment that there is no simple answer is overwhelmed by the richness of Dr Marsden's tale.

The book is an ecclesiastical history of the multicoloured and often warring denominations of American Protestantism in the half-century that ended in 1925 with the Scopes trial in Tennessee. Full-blown Fundamentalism was then only five years old and, Marsden says, never fully recovered from that defeat. Its end is symbolized by the death, on the Sunday after the trial ended, of William Jennings Bryan (counsel for the prosecution), once nearly President of the United States and afterwards, for a time, Woodrow Wilson's Secretary of State. But H. L. Mencken's savage obituary essay could not also serve as an epitaph for grass-roots Fundamentalism — there was too much of it. "Heave an egg out of a Pullman window and you will hit a Fundamentalist almost anywhere in the United States today."

By Marsden's account, Fundamentalism emerged from the reaction by Baptists and Presbyterians against the liberal theology taking hold in their denominations. But its origins lie in the "dispensational premillennialism" of the nineteenth century — the belief that the preordained history of the world specifies a final period (dispensation) of grace preceded by a second coming, itself the end-point of a period of social and moral degradation arranged by the Prince of Darkness. So the literal truth of the Bible, in particular the Revelation of St John the Divine, is the cornerstone of the faith, while saving souls against the second coming (Moody and Sankey in the United States, Spurgeon in Britain) is more important than social reform which might blunt the prophecy.

I had not known that the Fundamentalists own their name to the twelve-volume encyclopaedia of evangelical thought called *The Fundamentals* that was financed by the Californian oil-baron Lyman Stewart and was distributed free to more than 100,000 religious opinion-formers throughout the English-speaking world between 1910 and 1915. By then, the war between the premillennialists and the liberal theologians was well under way. There had been ructions among the Pres-

byterians about a proposed liberal revision of the "Confessions of Faith". Bible schools had sprung up, as had evangelists such as Billy Sunday — "I don't know any more about theology than a jack-rabbit knows about ping-pong, but I'm on my way to glory".

Marsden says that the Great War sharpened this conflict. Some premillennialists knew it to be the prelude to the Armageddon that had been prophesied. Bolshevism (1917) was another sign that the Prince of Darkness was at hand. The liberals, on the other hand, feared that such detachment would undermine the war effort. The social upheaval of demobilization, the financial crisis of 1919, the rise of gangsters and even the spread of cigarette smoking confirmed the premillennialists in their gloomy diagnosis. By 1920, both the Baptists and the Presbyterians were at loggerheads among themselves. The Fundamentalist crusade to purge the denominations of soft theology made the Scopes trial inevitable.

What explains the intensity of this dramatic conflict, centred, to begin with, in the north and not the south? Partly it was the nostalgic response to the final passing of the world order, signalled by the War. But Marsden persuasively explains how the tightly-knit immigrant communities of the early decades could have sensed each unfamiliar idea or unexpected event as a threat to the Protestant society they thought they had joined.

Politically, Fundamentalism was conservative (which is not the same as Republican) and fearful of an outside world seemingly rife with Bolshevism and Socialism. On balance, Marsden argues, Fundamentalism was not anti-science as such: indeed, it claimed to be the only scientific interpretation of the facts (the Bible). But evolution, "A string of guesses strung together", was a different kettle of fish. Marsden agrees that in the 1920s Fundamentalism was, for several interesting reasons, largely an American phenomenon. Perceptively, he asks what is to be made of the Fundamentalism now emerging in Islam and (in a footnote) in Ulster.

Marsden's history throws some light on those recent events in Arkansas even though 1981 is well outside his period. It explains why evolution is a unique challenge to Fundamentalism, and why Fundamentalism persists. For you cannot expect such a strong and recent tradition simply to melt away after a few set-backs in the courts. What Marsden does not for me sufficiently explain is why, in a republic in which church and state are constitutionally so separate, so many people have for so long invested so much energy and passion in such fierce and pointless arguments. "The God of your choice", it seems, demands a hard sell. □

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IMAGE UNAVAILABLE FOR COPYRIGHT REASONS

Cartoon from *The King's Business*, a premillennialist journal, May 1925. At this time the Fundamentalists saw Bolshevism, evolutionism and modernism as part of the same basic threat to Bible belief.

Expressing science

Maeve O'Connor

Writing a Scientific Paper and Speaking at Scientific Meetings, 5th Edn. By Vernon Booth. Pp.48. (The Biochemical Society: 1981.) £2.50, $6.

WRITING [maketh] an exact man, wrote Francis Bacon. How exact does it make scientists, already expected to be the most exact of men and women? And do they learn through writing to become not only more exact thinkers but, in turn, better writers?

Most editors would agree that although some scientists are superb writers and many are adequate, many more are imprecise, obscure, wordy or just plain careless. This is why journals tend to call for accuracy, simplicity and conciseness in their instructions to authors and why some editors devote hours to showing authors how to reach these goals. Editors and their requests for brevity are nevertheless often blamed for squeezing the life out of the so-called "literature". If blame must be assigned, however, we should direct it instead at educational systems that seem hard-pushed to produce literate graduates, never mind literate school-leavers. Yet scientists in particular, who must communicate their thinking successfully to other people if they are to help either society or their own careers, need some training in the art of presentation. Even in this age of cash crises, universities therefore ought to arrange appropriate courses. At present these are rare, but the return on the small investment needed could be enormous.

Until more courses become available, individuals could help themselves by studying one or two books on writing. Among these, Vernon Booth's booklet probably packs in the most good advice per square centimetre. This began life in 1971 as the Koch-Light Laboratories prize-winning essay. Dr Booth has revised and amplified the fourth edition (1977) and added eight pages on speaking at meetings. He does not claim to provide a complete text on how to write but simply to show readers how to avoid the mistakes he has met in scientific papers. He tells us what to do before writing, when to begin ("early") and how to get going ("Begin with the easiest section"). He gives useful hints on handling the various parts of a paper, and he covers all the commonest problems of literary style and punctuation in 12 succinct pages. In the section on speaking at scientific meetings he continues to administer sound advice, though little of this is particularly new. Like the rest, however, this section is pithily put and should be invaluable to busy scientists. □

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