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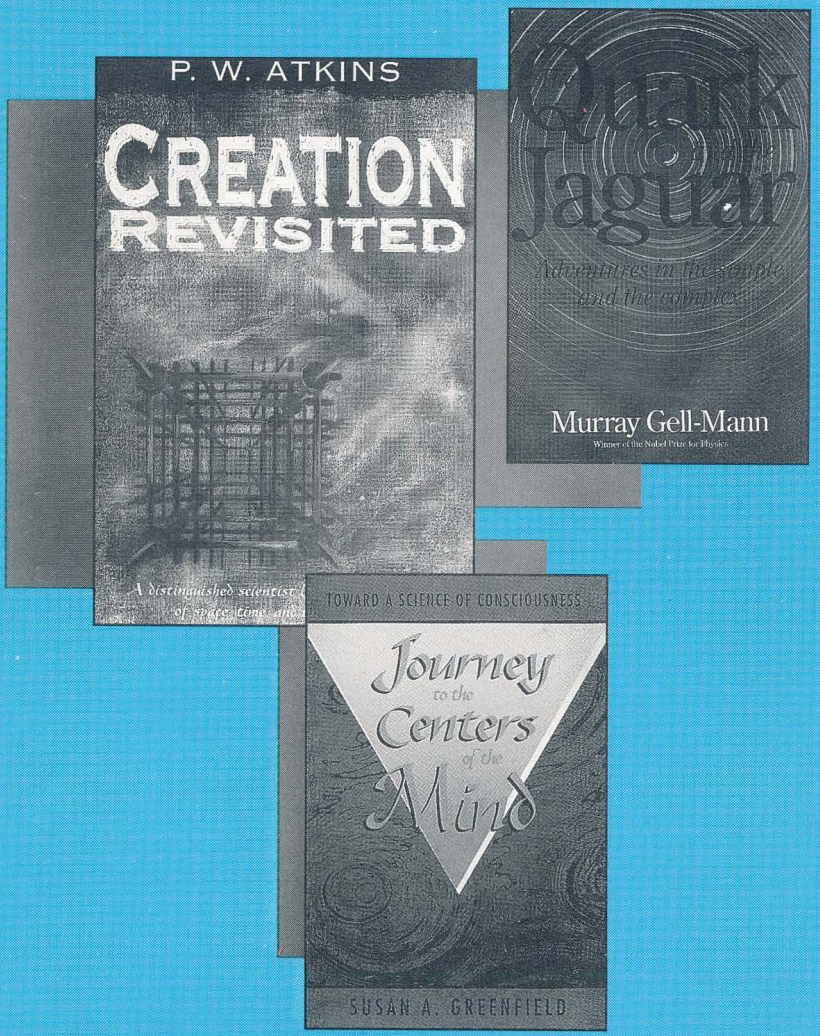

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EDITORIAL

The discussion between those who espouse creation science and those who accept some form of evolutionary process for creation still rumbles on, especially in the U.S.A. In this issue, Reg Luhman summarises the situation, and suggests a possible reconciliation. Mr. Luhman is an R.E. teacher with an interest in science, and thus experiences difficulties in understanding at first hand.

The extended review by Norman Myers is reproduced, with permission, from *Times Higher Education Supplement*. Dr. Myers feels keenly that Christians on the whole have shown little interest in the loss of biodiversity among the world's species. Maybe his article will stir some interest amongst us.

THE GREAT DIVORCE: CREATIONISM AND EVOLUTION

R.S. Luhman

TERMS OF SEPARATION

Scientific creationism can be summarised in the words of a Bill presented to the State of Arkansas in 1981, which stated:

'Creation science' means the scientific evidences for creation and inferences from these scientific evidences. Creation-science includes the scientific evidences and related inferences that indicate : (1) Sudden creation of the universe, energy and life from nothing; (2) the insufficiency of mutation and natural selection in bringing about development of all living kinds from a single organism; (3) Changes only within fixed limits of originally created kinds of plants and animals; (4) Separate ancestry for man and the apes; (5) Explanation of the earth's geology by catastrophism, including the occurrence of a worldwide flood; and (6) a relatively recent inception of the earth and living kinds.

Creationism presents a negative thesis that evolution is false and a positive thesis that purports to explain all the evidence adduced by evolutionists by means of an original special creation and a later catastrophic, universal flood.

Is evolution flawed?

Difficulties in evolutionary theory have been recognised since the time of Darwin himself. In *The Origin of Species* he devoted a chapter to such difficulties, which was to grow to two chapters by the final edition. What creationists tend to do is to ignore progress that has been made in resolving the difficulties and to present old problems as if they still caused difficulty.

In the textbook produced for use in schools and edited by Morris, it is claimed that evolution by mutation and natural selection is impossible on statistical grounds, that similarities in morphology at a level higher than species is an evolutionary assumption without any experimental underpinning and that the fossil evidence disproves evolution. The authors claim that there are no unequivocal Precambrian fossils which can explain the Cambrian explosion and there are no transitional forms linking the major groups of plants and animals. They claim, "Of much more significance is the fact that each of the various orders of amphibians, reptiles and mammals appears suddenly in the fossil record, without incipient forms leading up to it and without transitional forms between it and any other order."[1] It is interesting that creationists support their arguments either by quoting evolutionists out of context, for example J.H. Corner's comment, found in nearly all creationist books, that ". . . I still think that to the unprejudiced, the fossil record of plants is in favour of special creation." or by quoting from texts that are well out of date, for example D.I. Axelrod's article in a 1958 volume of *Science*. Where apparent transitional fossils exist, for example the *archaeopteryx*, these are explained away in this case by saying it is unequivocally a bird.

Mutations and Natural Selection

Evolutionists would agree that most mutations are harmful but would insist that a small, but significant proportion of them are advantageous, especially those induced by radiation or chemicals, and these may virtually offset the effect of the majority of unfavourable mutants.[2] An experiment with fruit flies shows how a usually damaging mutation could, under specific circumstances, be selected. It was observed that on some Hawaiian island, where winged flies could be blown out to sea and killed, there were more wingless varieties found. In the experiment the winged variety usually outproduced the wingless ones, but the opposite occurred when a current of air blown through the cages and the flies caught in it were removed. Other mutated flies were released with natural populations and, after an initial population collapse, soon overtook the native population in numbers. It is now known that there are enough variations within a population for evolution to occur. What is important for natural selection is not

merely the existence of different versions of the genetic code within an individual, which provides the raw material for change, but the alteration of the environment, which determines which 'favoured' ones will survive and reproduce.

The absence of transitional forms

The case against the existence of transitional types seems impressive but it tends to be based on critics stressing evidence which supports their case and ignoring any evidence to the contrary. In 1985 Hoyle and Wickramasinghe claimed that the original *archaeopteryx* fossil was a forgery with the feather impressions superimposed on a small dinosaur skeleton. If they were right then presumably the critics would have to insist that the features that appear reptilian are the genuine ones and not the avian ones that are now taken to prove it is a bird. It is unlikely that Hoyle's allegation is true. the present custodians of the fossil at the British Museum have convincingly answered him by pointing out that five other specimens of *archaeopteryx* were found between 1855 and 1956 and it is unlikely that all would have been tampered with. This would have been impossible if the forger was Richard Owen, who was Darwin's contemporary and arch-enemy. He would certainly not have wanted to bolster Darwin's theory, which was proposed as the likely motive for the fraud.[3]

Evolutionary biologists readily admit that there is insufficient palaeontological evidence to answer all problems. Reptilian eggs are more complicated than amphibian eggs and have at least eight innovations, but unfortunately we only have fossilised dinosaur (reptilian) eggs and not amphibian eggs and therefore are unable to discover whether primitive amphibian eggs were transitional. Similarly, although there are fossils of flying reptiles and of flying birds, none of these enables us to show conclusively how flight developed or feathers were first formed.[4] There is no lack of speculation but this takes the form of 'just so' stories or 'after the event guesses'. The lack of fossilised soft parts means that we cannot know whether dinosaurs were warm-blooded as Robert Bakker suggested, or cold-blooded like modern reptiles. Occasionally, as in the case of the *coelacanth*, which is a close surviving relative of the extinct fish order *Rhipidistia*, scientists have been able to examine the internal organs and have found nothing that would pre-dispose it for life on land and have been able to exclude it as a direct link between fish and land vertebrates. Creationists continually stress the improbability, not to say impossibility, of certain transitions. For instance there is the problem of the transition from reptilian to mammalian jaw. Reptiles have at least four bones on each side of the lower jaw and one bone in each ear, but with mammals the situation is reversed. Monty White states categorically, "There are no reptilian-mammalian transitional forms showing, for instance, two or three jaw bones or two ear bones. The idea of bones gradually migrating from the jaw into the ear is also difficult to imagine. Furthermore, how a transitional form would have managed to chew while its jaw

was being unhinged and rearticulated is also difficult to imagine; so also is how it managed to hear while its jaw bones were migrating to its ears!"[5] In this case fossils have proved the critic wrong. J. Levinton pointed out, "Even the jaw joint changed from one fulcrum to another; in some transitional fossils the reptilian jaw co-exists with the mammalian jaw-joint. If one compared modern reptiles and mammals, it would seem impossible for the articulation of the jaw to change from one set of bones to another without a monstrous, drastic (and highly unlikely) mutation, but the fossils prove that the mammalian jaw underwent gradual evolution through intermediate forms."[6]

Interpreting the Fossil Record

If Darwin was right then we would expect that no two organisms would be alike and that many mutations would arise giving impossible creatures that could not survive and others, like wingless flies, which would have little chance of survival. However, if circumstances were favourable, wingless flies would survive and breed. If offspring only differed by small amounts we would expect 'transitional' forms to possess a mosaic of features illustrating both the creature it has come from and what it will become. This is what is found. The *archaeopteryx* contains reptilian and avian characteristics and the monotremes reptilian and mammalian characters. What we do not find, and would not expect to find, are animals with organs that do not function at all, although we may find organs that function inefficiently, as in the case of flightless birds. What is perhaps significant is that the monotremes and flightless birds, like the kiwi and the extinct dodo, are found on islands where there were no natural predators until man appeared.

Richard Dawkins constructed a computer program to simulate, in a grossly simplified way, the working of natural selection. He demonstrated that from simple tree-like shapes he could get all sorts of variations which resemble creatures of many different sorts, which he called 'biomorphs'. Each biomorph on the screen was one of a tiny subset that could exist. He argued that in the genetic world the animals that have existed, and now exist, are only a tiny sub-set of the theoretical animals that could exist. Many of the trajectories gave rise to impossible animals that could not survive but others gave rise to animals that could, and perhaps did, exist when the circumstances were favourable. He believes that, "In theory, if we were skilled enough in genetic engineering, we could move from any point in animal space to any other point. From any starting point we could move through a maze in such a way as to recreate the dodo, the tyrannosaur and trilobites. If only we knew the genes to tinker with, which bits of chromosomes to duplicate, invert or delete (we could resurrect . . . those dear dead creatures (who) are lurking there forever in their private corners of the huge genetic hypervolume."[7]

The fossil record shows a consistent pattern. There is an initial short phase when many 'experimental' lineages are formed and radiate outwards

unconstrained by competition. This is followed by a period of stabilisation when lineages settle in different ecological niches. Experimental lineages, which are not well adapted, come to an end, often by extinction, and only well adapted ones survive and slowly evolve. Some environments, like the oceans, do not change much and for this reason fossils of sea creatures may exhibit little change over geological time. Indeed Darwin acknowledged that, "Many species once formed never undergo any further change . . . and the periods, during which species have undergone modification, though long as measured by years, have probably been short in comparison with the periods during which they retain the same form."[8] This is virtually the same as **punctuated equilibrium**, which is associated with Niles Eldredge and Stephen Gould and often thought to be the antithesis of Darwinian evolution. Darwin believed that species generally arose as a result of geographical isolation. When a group of animals occupies a new habitat where there is little competition and no predator, there will be a population explosion, and rapid evolution. This will be followed by a drop in numbers, because of the impoverished gene pool due to interbreeding, and finally the emergence of a population very different from the original stock. There is support for this from living species, like the devil's pupfish in Death Valley and Hawaiian moths which feeds exclusively on bananas, that have become morphologically diverse in less than a thousand years. Geographical isolation might also help to explain the lack of transitional fossils. Because speciation occurred in geographical isolation, the fossils found in a particular place represent migrational events where a new species, which has evolved elsewhere, returns and becomes dominant.

The Problem of Origins

Since Darwin's time, over one hundred thousand fossil species have been discovered but one of his problems still remain - the explanation of the Cambrian explosion when, according to Levinton, "All the known animal phyla that readily fossilize appeared." He continues, "We cannot be sure how early within it the phyla arose. Nevertheless, compared with the context of the 3.5 billion years of all biological history and the roughly 570 million years since the start of the Cambrian, the phyla do seem to have appeared suddenly and simultaneously."[9] Creationists tend to agree with Darwin's contemporary, R.I. Murchison, in seeing this as the 'first fiat of Creation', and although Gish is prepared to accept the existence of Precambrian fossils, for Morris Precambrian rocks devoid of fossils indicate rocks laid down in creation week as opposed to fossiliferous ones that were deposited by the Flood.

The earliest rocks contain microfossils of primitive bacteria found in colonies (stromatolites) which were **prokaryotes** (DNA within a membrane). Over a million years passed before more complicated **eukaryotic** cells arose. Stephen Gould, in his definitive study of the Burgess Shale, which represents the best collections of fossilised life forms at the beginning of the Cambrian, asks the obvious question as to why life should stay so long at the prokaryotic stage when

complexity offers such benefits. It has often been argued that the missing links between the single-celled Precambrian fossils and the multi-cellular Cambrian ones did not survive as fossils because they lacked hard parts, like shells. However, the earliest multicellular creatures found in the Ediacara hills of Southern Australia contained fossilised soft-bodied remains. Gould, who can hardly be accused of Christian bias, asks, ". . . if the true ancestors of the Cambrian creatures lacked hard parts, why have we not found them in the abundant deposits that contain the soft-bodied Ediacara fossils?"[10]

There have been many suggested explanations for the Cambrian explosion. The most popular one is that the world was comparatively empty and therefore everything could expand without hindrance. Others have argued that the earliest genomes were more simple and flexible and that since then the multiplication of multiple copies has tied the genes up in web of interactions that cannot be easily broken and so has put a brake on large changes. For Gould it is all a matter of luck. Of the twenty five body plans he found in the Burgess Shale only four led to enormously successful groups.

One of the thorniest evolutionary riddles concerns the origin of living from non-living material. Even Dawkins has to admit that we have a problem and resolves it by resorting to 'miracle' by which he means ". . . a more or less improbable natural event . . . a tremendous stroke of luck," He believes that, given sufficient time, life is bound to appear spontaneously but says he would ". . . be worried if it turned out to be easy for chemists to obtain life spontaneously in a test-tube," but then maintains that "Having said all this I must confess that . . . if a chemist *did* succeed in creating spontaneous life I would not actually be disconcerted."[11] The earliest attempt at creating life by Miller and Urey in 1953 actually produced a minute quantity of amino-acids. These were created under ideal conditions which would not occur in nature. They also removed the products from the reactive medium, which would otherwise destroy them. Fox later claimed to produce 'proteinoids' by replicating conditions similar to the rim of a volcano. Miller now questions whether such results are feasible. "Another way of examining the problem is by asking whether there are places on the earth today where we could drop, say, 10 grams of a mixture of amino-acids and obtain a significant yield of polypeptides (essentially Fox's proteinoids) . . . we cannot think of a single such place." Even if this could happen it would be nowhere near a simple cell, which is a miniaturised factory of over 100,000,000,000 atoms. The basic problem is a chicken and egg one. DNA cannot be made without enzymes and enzymes cannot be produced without DNA. The basic self-replicating primitive cell was ". . . faced with the seeming paradox that in order to develop a more accurate translation apparatus it had first to translate more accurately." Francis Crick therefore concludes, "An honest man, armed with all the knowledge available to us now, could only state in some sense, the origin of life appears at the moment to be almost a miracle, so many are the conditions which would have

to be satisfied to get it going."[12] Perhaps this is why Darwin ended the *Origin* with "There is a grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one."

Young Earth and Universal Flood

Whitcomb and Morris claimed that all the features of the earth were formed in one natural week. On the first day the earth's core was made ready and on the second the firmament (the troposphere) was put into place. Some of the mountains were formed on the third day and the distortion of the earth's crust caused dry land to appear. The sun and moon were created on the fourth day so the light bathing the earth on the first day came from elsewhere. Sea creatures and birds were created on the fifth day and land animals and man on the sixth. The problem of how the light reached earth is such a short time is resolved in several ways. One suggestion by Morris is that ". . . it was created in space as *en route* from the innumerable 'light bearers' which were as yet to be constituted on the fourth day."[13] Another was to resurrect a paper about the theory of relativity which concluded that if two quite different spaces co-existed and were superimposed upon each other, then it would be possible for light to travel 1,000 light years in only 15.6 years. Neither Harold Slusher[14] nor Monty White [15] point out that the original authors were in fact talking about a mathematical abstraction that cannot be applied to the real world. In 'Scientific Creationism' Morris argues that evolution contradicts the second law of thermodynamics and then, surprisingly, goes on to claim that the laws only came into existence after the fall of man. The universal 'bondage to decay' represents the second law and God's sustenance of His creation is the first law of the conservation of mass-energy!

The main thrust of Whitcomb and Morris' work is to argue that all the fossils were deposited by Noah's Flood. Prior to the flood, a water canopy is said to have surrounded the earth giving it a uniform warm climate. The bursting of this canopy released an immense amount of water. This was accompanied by subterranean volcanic eruptions which were responsible for all metamorphic and igneous rocks. The sedimentary rocks were formed by the deposition of material carried along by the flood waters. The improbabilities involved are apparent when one considers what is involved. If the water canopy increased the ocean volume by thirty per cent then it would have occupied 75 million cubic miles and have raised the atmospheric pressure to 950 pounds per square inch and the temperature to 265 degrees centigrade. The effect of the subterranean eruptions would be to raise the water temperature to 2,700 degrees centigrade - enough to melt the pitch of the ark and fry everything on it. Whitcomb and Morris calculate that there were about 35,000 animals on the ark, which conveniently migrated towards it and hibernated on it during the year of the flood.

The distribution of fossils is explained by each group of creatures occupying specific ecological zones, by speed of locomotion and hydrodynamic sorting

which would sort animals and plants into specific sizes and shapes. Marine invertebrates would be trapped at the bottom, then amphibians and reptiles with birds and mammals at the top. Hayward comments that "This sounds fine, until you stop to think. Then you begin to wonder: why is there not a single human fossil below the topmost layer? Were there no inhabitants of the coastal plains overwhelmed in their sleep? No cripples or sick folk unable to flee? And why are the pterodactyl fossils in the middle layers? You would think that at least one or two of them would have flapped their wings to the hilltops."[16] There are too many fossils. Just the animals would represent a population of two thousand to an acre.

The young earth view faces immense challenges from orthodox geology. It is difficult to account for coral reefs which grow in lightly agitated warm water a few centimetres a year. How could coral several thousand feet thick be deposited by turbulent flood waters in a few months? Even more remarkable is that reefs appear on top of sandstone which must have been gently deposited by the Flood while the coral was held in suspension. Similar problems arise with evaporites, which would be dissolved in the flood waters. As they are often found beneath thicknesses of sedimentary rock, supposedly deposited by the Flood, they could not have been put down after the water had evaporated.

Creationists are quick to criticise dating methods but some, like varve dating, are difficult to dispose of. In Utah and Colorado there are several million layers with pollen and spore particles fossilised in the dark (summer) layers. Hayward comments, "There is no possibility that a great flood - or any other catastrophe for that matter - could have produced *millions* of paper-thin bands of alternating light and dark colour in an extensive deposit of shale. Above all, there is no way that pollen could have found its way into the darker bands, and *only* the darker bands, unless they were produced at yearly intervals over a vast period."[17] Often creationists give the misleading impression that radiometric dating is wildly inaccurate. For instance they quote H.C. Dudley to the effect that radioactive decay rates are not constant but fail to point out point out that when we allow for the variations we still have an age of nearly a million years. When all else fails the creationist can always appeal to 'the appearance of age' view, that is that God created everything with an 'apparent age', for instance Adam might have been created with the appearance of being twenty years old.

SEEKING A RECONCILIATION

Biblical Interpretation

Christian contemporaries of Darwin seemed to have less problems than modern creationists in reconciling evolution with belief in God and the Bible. Various attempts were made to harmonise the Genesis account with the growing scientific knowledge. The reconstitution (or gap) theory was proposed by

Thomas Chalmers and popularised in the Scofield Bible. It has few adherents today[18] and is based on a dubious translation of Genesis 1, 2 and proposes that Genesis recounts the recreation of the earth after the original creation had been destroyed by God. A popular view held by nineteenth century geologists like James Dana and J.W. Dawkins, which went back to Augustine, was that the days of Genesis represented long ages. Young had earlier adopted it[19] although he was aware of its limitations, not least that there was an overlap of creative activity of the various days and that the sun, moon and stars cannot have been created on the fourth day. A Jesuit priest suggested that the days of Genesis were not accounts of God's activity, but days when he revealed what He had done. This view was later popularised by P.J. Wiseman [20] and has been recently argued by his son, Donald [21] who points out that in both Sumerian and Jewish tradition God is said to have revealed his creative activity in six days. It is better to view Genesis in its original setting which has little to do with science. We know that the Babylonians had their own creation stories and it was once maintained that Genesis is a variation of Mesopotamian mythology. Recent discovery has undermined this view. Instead Genesis should be seen as a polemic against such mythology. It is interesting to note that Genesis does not use the Hebrew words for 'sun' and 'moon', probably because they are similar to those used for the Sumerian sun and moon gods. Also special reference is made to the creation of great sea monsters, even using the Hebrew word *bara* (cf. 1.1), which suggests that the author wanted to stress that they need not fear the monsters of the deep because they too were created by God.[22]

Progressive Creation

Creationists, among them those who reject the young earth view, believe that God created specific ancestral groups of animals or prototypes (the 'kinds' of Genesis) which were capable of slight alterations to allow them to adapt to a changing environment.[23] A similar idea was held by Darwin's friend, the Duke of Argyll, and was rejected by Darwin as 'rubbish'. He said that, "I would give nothing for the theory of natural selection, if it requires additions at any one stage of descent." Lester and Bohlin[24] have sought to identify the biological prototypes in a strict fashion. Gish, similarly, regards kinds as all animals and plants that derive from a single population or gene pool, yet he also wants ". . . the gibbons, orangutangs, chimpanzees and gorillas (to each) . . . to be included in a different basic kind."[25] In fact they are more closely related than other animals that he includes in the same 'kind'. The reason is obvious. Human beings are genetically very close to the great apes.

Progressive creationists are those who accept the earth is millions of years old and believe that God introduced prototypes at certain stages of the earth's history. This has the disadvantage of being a 'God of the gaps' approach which is vulnerable to being exploded as the gaps are filled with increased knowledge.

Theistic Evolution

The author and Cambridge professor Charles Kingsley wrote, "We knew of old that God is so wise that He could make all things; but behold, He is much wiser than even that, that He can make all things make themselves."[26] Theistic evolution is the creationists' *bête noire*. Morris claims that it is inconsistent with God's omnipotence because He could create the world in an instant: with His purposiveness, because He would not waste millions of years of meandering and extinction, and with His love, because He would not make a world with predation and the cruelty of the struggle for existence. The latter echoes Darwin's reaction. He wrote, "We cease to be astonished, however much we may deplore, that a group of animals should have been directly created to lay their eggs in bowels and flesh of others (sic)."[27] This is part of the larger problem of evil. Creationists believe that they can solve it by claiming that it is all the aftermath of the fall of man but, if so, how is God's righteousness and love shown by punishing the animals for mankind's sin? Johnson is surely right when he points out that the teeth of lions and the talons of birds of prey show evidence of design rather than being ". . . something hastily contrived to satisfy the craving for meat which tens of thousands of species suddenly developed."[28] It is often assumed that the alternative to the survival of the fittest is animals living together harmoniously. In fact it is more likely to be a decadent world of overpopulation, starvation and the weakening of the gene pool.

Darwin realised that evolution could have no specific goal but found it difficult to come to terms with this. He wrote, "I am conscious that I am in an utterly hopeless muddle. I cannot think that the world, as we see it, is the result of chance; and yet I cannot look at each separate thing as the result of Design."[29] Dawkins clearly sees that the issue between himself, the atheist, and the theist is concerned with purpose. In an exchange with Michael Poole he showed his misconception of the Christian concept of God. His understanding of God is someone who started the universe and left it to work itself out and who is in need of explanation. He has always insisted that, ". . . propagating DNA . . . is every living object's sole reason for living", but in his 1991 Christmas lectures he let his guard drop by suggesting that, "some of life must be devoted to living itself; some of life must be devoted to doing something worthwhile with one's life, not just perpetuating it."[30]

As we saw earlier, the biggest problem for evolution is the origin of life. Taking this as his starting point, Gordon Mills has developed a viable theory of theistic evolution.[31] He points out that there is no convincing evidence at the biological level that atoms and molecules spontaneously form into the necessary building blocks of life (amino acids, purines, pyrimidines etc.) nor that they have innate properties that would cause them to form the informational macromolecules essential to life. He proposes a scenario in which God, the omnipotent author, sustainer and finisher of all natural processes, continually

provides new genetic information. Unlike progressive creation, which has God creating prototypes in the course of the world's history and is open to the charge of a 'God of the gaps' theology, his theory has a Creator, ". . . having a continuing involvement in creation, not only in providing infusions of genetic information, but also as author, sustainer and finisher of all natural processes." Unlike naturalistic evolution it does not rely on chance events but on an intelligent cause. Of course it may not be possible easily to distinguish what is random from a determined event but an omnipotent and omniscient being who is outside of time would be able to know all the factors in what we consider chance events and be able to control them in such a way that every point in space and every moment in time is dependent on God. Mills proposes his view as a genuinely scientific thesis and, as such, makes it open to criticism. If this view can be established as genuine scientific alternative then I believe we have a way of ending the great divorce and of reconciling creation and evolution.

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A BIOTIC HOLOCAUST

Norman Myers

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E.B. Barbier, J.C. Burgess and C. Folke, *Paradise Lost?* (Earthscan, 267 pp., £14.95, ISBN 1 85383 181 6)

David Pearce and Dominic Moran, *The Economic Value of Biodiversity* (Earthscan, 172pp., £32.50 and £12.95, ISBN 1 85383 225 1 and 195 6)

What a plethora of books on biodiversity. At least a dozen distinguished ones have appeared during 1994 alone, and twice as many are in the publishing pipeline. And rightly so. The decline of biodiversity can be regarded as the most critical of Earth's environmental crises insofar as it is irreversible. All our other problems are intrinsically reversible. The biodiversity crisis, aka biodepletion, is different. When a single species is gone, that is it - and we are already into the opening phase of a mass extinction consuming millions of species. The Earth's experience of mass extinctions in the geological past suggests that the present phenomenon, if allowed to persist unabated, will impoverish the biosphere for five million years, possibly several times longer.

Yet biodiversity receives less attention than it deserves. That is to say biodiversity in its proper full sense, not rhinos or whales or a few other the "charismatic megavertebrates", but rather the biodiversity that involves invertebrates and especially insects for the most part, creatures that with their many millions comprise 90 per cent of species. By contrast, vertebrates of whatever size and shape make up a maximum of 0.4 per cent of all species.

When people hear that we may well be losing 50 to 100 species every day , they may respond: "What has biodiversity ever done for me?" The answer is that there is a one in four chance that the medicine or drug they purchase in a chemist's shop derives from a wild plant. One of the biggest breakthroughs against cancer in the past 30 years came from two biocompounds obtained from the rosy periwinkle, which are potent against Hodgkin's disease, childhood leukemia and other blood cancers. Scientists believe that tropical forests contain at least another 12 plants potent against other forms of cancer - provided plant experts can study them before their habitats are destroyed.

The commercial value of plant-based medicinals is around $50 billion a year in just the rich nations, while the "green medicine" that forms the medical mainstay for developing nations is worth another $50 billion. Yet a mere 1 per cent of species has been examined to date, and according to the current rate of

extinction, a full quarter of Earth's plant species will have gone by the time today's infants are old enough to read *The THES*. Much the same can be said of species' contribution to new foods and industrial raw materials and even sources of energy. The world is now stirring itself to stem this biotic holocaust. At the Rio Earth Summit in 1992 virtually all nations signed a Biodiversity Convention. Alas, government signatures alone do not save much, and thus far we have scarcely slowed the annual acceleration in the extinction rate (already 100,000 times the "natural" rate before the arrival of humans). What will help to push governments into action is public opinion; and this will be aided by the four books under review.

The first, *The Biophilia Hypothesis*, deals with what one of its editors, E.O. Wilson, terms "our innate affinity for the the natural world" - or "biophilia". In an earlier book on the topic, Wilson has postulated that there might well be a biological need underpinning our intimate bonds with nature, and that this need could play a vital role in our development as individuals and as a species.

The thesis plainly appeals to a number of front-rank analysts, as witness the contributors to this book who include Gordon Orians, Gary Nabhan, Lynn Margulis, Madhav Gadgil and David Orr. In 15 position papers we read about biophilia in relation to the conservation ethic, human evaluation of nature, the "spiritual ecology" of hunter-gatherers, the Gaia concept, and many more variations on the biophilia theme. Along the way we encounter much evidence in support of biophilia, together with its opposite biophobia. Consider, for instance, our apparently inborn delight in flowers, trees, water and diversified landscapes, and the equally inborn dislike of spiders and snakes. Many traditions and cultural icons depend upon symbols drawn from nature, especially animals, such as the lions that appear in legends from far and wide. As biodiversity disappears and we become further estranged from the natural world, we may well find that we are not only impoverished in biological and material senses, but that we have been made bereft in cultural, symbolic, psychological and even spiritual senses. To the extent that the biophilia thesis stands up, it provides an additional potent argument for conserving biodiversity.

Does it stand up? Certainly the book makes the case well, though it might have been improved with the addition of the odd paper by a sceptic. It may indeed be that the savannah environments of the formative periods of human evolution are the reason why we now enjoy open and lightly-wooded landscapes, and esteem their more powerful denizens such as lions; and that, conversely, we eschew thick forests and disparage their beasts such as wolves and bears, and hence few monuments feature wolves as appendages to human heroes, while the wood-cutter often features as the guardian of human interests. But this is not self-evidently true.

The second book, *Essentials of Conservation Biology*, is much more of a textbook though perfectly readable. Covering the new sub-discipline of conservation

biology its authoritative text presents analyses of such basic concepts as keystone species, genetic variability, trophic levels, island biogeography, rareness, endangerment, exotics, endemics, extinction vortices, population viability minimum gene pools, and the latest conservation imperative, restoration ecology. The book does not limit itself to biology, ecology, genetics and evolution so as to embrace such a wide-ranging agenda: it draws too on economics, law, anthropology, history, philosophy, ethics and politics. A broad approach indeed, which none the less works in R.B. Primack's skilful hands.

There are concise discussion of such issues as how species come to occur, the reasons for the global decline of amphibians, the wisdom or otherwise of spending $15 million on the Californian condor, hot-spot concentrations of species, the decline of the songbird in North America, the marketing of elephant feet for wastepaper baskets, debt-for-nature swaps, and the non-utilitarian value of species. The book raises questions such as why most species live in the tropics and especially in tropical forests: with 6 per cent of earth's land surface, these forests contain at least 60 per cent of all species, yet they are the most threatened of all the large-scale ecological zones. And there are surprising findings on numerous topics. For instance, advancing technology is still the cause of far more job losses among lumberjacks in Oregon's forests than are Oregon's much-publicised efforts to preserve the spotted owl. Finally, the book's abundant illustrations and its 1,000 references in almost 600 pages make it exceptional value. Altogether, it is a first-rate overview of the subject.

The third book, *Paradise Lost?*, approaches the problem of biodepletion from an economic standpoint. Written under the auspices of the Beijer International Institute of Ecological Economics in Stockholm, it seeks to promote a dialogue about biodiversity between ecologists and economists. In my opinion - and I have a foot in both camps - there has been no greater organisational roadblock in the whole environmental arena than the disinclination of these two parties to talk to each other during the past few decades. I must salute a book that at least tries to foster an exchange and even an integration of views.

Ecologists tend to say that we need all the biodiversity we can preserve: every last bit is precious. Economists respond that human ingenuity and technological know-how will compensate for biodepletion - just as they have always overcome problems to do with our finite resources. This book takes the debate far beyond this basic stand-off. Ecologists are compelled to reflect on the fact that we cannot afford to save everything and that no species is "beyond value". At the same time, economists would do well to consider that there is next to no market in the goods and service supplied by, say, the Californian condor, and hence hardly any way for "conservationist consumers" to register their preferences with their dollar votes. It is no solution to ask people what they would pay to preserve the bird and take this as a proxy evaluation. Most people have little understanding of the condor's ecological worth, let alone its many

other values, moreover surveys of "willingness to pay" take no account of people as yet unborn.

There are two central problems, the first of which is well explored in the book, the second less so. We face huge uncertainty as to the ultimate overall value of biodiversity, especially in terms of its many environmental functions and ecosystem services. We have hardly a preliminary idea of "the minimum threshold level [of biodiversity] to sustain human welfare and even existence". hence we should deploy extreme caution in deciding how much biodiversity we should allow to disappear. Because of this uncertainty, we should maintain the maximum amount of biodiversity. The authors of *Paradise Lost?*, by contrast, assert that we should aim to safeguard whatever "minimum level of biodiversity is required to maintain human welfare", and hence that "biodiversity conservation does not require complete preservation of all species in the world". If only we had the wisdom of Solomon to make such momentous judgements.

Second, what is the most suitable criterion to guide our decisions? Does it truly lie with "human welfare"? The economist would reply with Alexander Pope that man is the measure of all things, and that we cannot even talk of value except within a human context (implying, presumably, that values do not exist on the Moon except when the earthling astronauts are there to hold them). So the traditional approach of economics has been that we should mobilise the earth's resources to support humankind's cause. Yet at a time when segments of the planetary ecosystem face terminal threat, should we not seek to mobilise humanity's resources in support of the planetary cause - and thereby give ourselves our best and perhaps only chance of worthwhile existence? Fortunately the authors broach this challenge, albeit in ultra-tentative terms, in their final chapter where they express the hope that we need to "change our current understanding [of the biodiversity problem] based on a more integrated ecological-economic approach". If only they had taken a more powerful stance on this need in what is otherwise a fine book, strongly recommended.

The final book, *The Economic Value of Biodiversity*, postulates that if we could only calculate the full value of, say, an elephant, we would be in a much better position to persuade politicians and policy-makers that the species is worth preserving in competition with other ways of expending public money. But it is next to impossible to assess the true overall value of a species. An elephant is worth far more than its ivory and other physical products. Each of the few hundred elephants in Kenya's Amboseli Park brings in thousands of tourist dollars year after year. Elephants perform prodigious environmental services through their impact on vegetation - in opening up woodlands, for example, to the benefit of associated species. And what price shall we put on what John Donne called "the only gentle great thing"? Unless we can do a better job of "capturing" the myriad values represented by elephants, including those bestowed through their mere existence, we shall likely be doomed to watch them

disappear. David Pearce and Dominic Moran readily recognise the limitations of economics. More books like this will help to push back the boundaries of our understanding, all too constrained as it is.

To return to the irreversibility of lost biodiversity. Biodepletion will not only visit deprivation on people today, it will impoverish our descendants for 20 times longer than the period since humans first emerged as a species. As E.O. Wilson points out, the world could recover within a decade from a seismic economic slump, and it could even pick itself up from a nuclear exchange within a century at most. The biodiversity crisis is different, the most far-reaching decision humankind has faced.

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SCIENCE AND SPIRITUAL VALUES

This was the title of a discussion under the auspices of the Scientific and Medical Network *(see below) which took place on January 17 1996 at Church House, Westminster. The Editor was present, and what follows is a brief summary of an interesting evening.*

The philosopher, Max Payne, was in the chair, and prefaced the discussion with some remarks of his own. Today religion seems under threat, but then so also is science. If we want a definition of spirituality, then a minimalist sentence might be 'spirituality is those values and purposes which transcend human life'. In the past, religion has been synonymous with spirituality, whereas science has been thought to be 'value-free'. Today this is much under discussion, and the 'conflict' between science and religion has waned. It has been mainly a conflict about method, that is, between experimentation and questioning, as against faith and authority. At the end of the 20th century **all** human values seem under attack.

The first speaker was Tim Ingold, Professor of Social Anthropology in Manchester University. From an anthropologist's viewpoint, there seems a dichotomy between nature and mind, and a conflict between 'science' and 'humanities'. Anthropology and science are on the same 'level', but anthropology is often thought to describe the 'other person's views'. If we take evolutionary biology as an example of science, then Darwinism claims there to be a continuity between human beings and the rest of creation. But evolutionists often seem to be set on defining human-kind as **different** in some way. Why is this? Professor Ingold suggested that biology needs a 'platform' from which to deliver statements about the world from a special viewpoint. That is, we take **ourselves** out of the world in order to explain **ourselves**. But anthropologists try and take a holistic view - that we are all part of the same world.

The non-Western world is often regarded as more 'spiritual' than 'secular' to us in the West. For example, the aborigine in Australia is attached to his landscape: "We are born from this, and to this we shall return at death". When westerners write about such a culture, they get it wrong, talking about spiritual rather than secular. The Cree Indian feels that the world is peopled by non-humans and that there is a balance between agencies of all kinds - animal, human, plant etc. Again westerners say - spiritual rather than secular. But is this view **ours** rather than **theirs**? The world does care what humans believe about it, and being in the world means being committed to it, **all** of it.

Are humans unique in nature, in the sense that they can imagine they can be outside, looking in? Humans can also feel the crisis of meaninglessness. We need to get back into the world, and to pay more attention to intuition - sensibility to the environment.

Craftsmanship is an intuitive skill where meaning is revealed rather than acquired by knowing. When we **see**, we examine the world and look within it. It is seeing as distinct from spectating. In the relationship between the intuitive and the scientific view, has science lost touch with the practical skills, such as the botanist used to have?

In conclusion, we could say that we do not want an opposition between scientific and spiritual values. We do not want to go out of the world; we need to go deeper within, into the ordinary world we know. The forms of organism we find are emergent properties of the system, that is, the whole is greater than the sum of its parts. Evolution then becomes the unfolding of relationships. Consciousness is not added on to life to transform the world; we are all part of the growth of the world as a **whole**.

The second speaker, Mary Midgeley was, until retirement, Senior Lecturer in Philosophy at Newcastle. She was anxious to develop the same points as Tim Ingold rather than taking an opposite stance. Dualism in Western philosophy is an odd phenomenon. Descartes led the way by separating soul and body - there are only objects, no subjects. Modern science has pushed this to the limits, but things are changing, and the matter of consciousness is something to wrestle with. Descartes did not imply a dichotomy between science and spirit - he was interested in both. But he opened a gap, and did not see a direct connection between soul and body, mind and matter. He simplified matters to mathematics, physics and the investigation of knowledge. At that time it was not pointed out that a reconciliation would be possible. 'Wholeness' could have been retained, so why wasn't it? Simplification was tempting, and led to reductionism. A realistic compromise was not popular, and the political issues of the time lent support to this. The Church tended to abuse its authority by suppressing heresy, and religious wars were ever-present. The Enlightenment proposed reason as the authority - 'cogito, ergo sum'. Anti-clerical feeling led to the rise of materialism. One could ask, 'Why is it that scientists always attack religion, rather than other

human activities?' Subjectivity is suspect, emotion taboo. Behavioural psychology has been considered not worthy of study, and in medicine there has been been difficulty in explaining the psychosomatic (the influence of mind on the body).

Thus it is that objectors to the *Gaia* idea today will say 'We must not talk religion' whereas in previous eras this would be considered a strange attitude. Thus we are confronted by taboos, but scientists such as Lovelock and Margulis may help us find our way.

Consciousness is currently under active investigation. There are many disputes over artificial intelligence: are artificial life forms 'conscious'? Moreover, physics itself has become 'blurred at the edges' and we know that the presence of the observer can alter the state of the observed. Physicists are finding this hard to come to terms with.

A time for questions followed, but space does not permit a detailed account of this. It was pointed out that science very often advances by an intuitive step. Some discussion centred on psychical research - is parapsychology a scientific discipline? Do computers show intuition? Values and relativism was another big issue, but a 'grey area' these days.

It was felt by some that the spiritual side had not been properly addressed: for example, mystic experiences, personhood, the Eastern religions.

It was an interesting evening, and future such gatherings will be reported upon later.

WHAT IS THE NETWORK?

The *Scientific and Medical Network* is an informal international group consisting mainly of qualified scientists and doctors, together with psychologists, engineers, philosophers, therapists and other professionals. It was founded in 1973 and now has a Membership of 1,500 in over 50 countires. The aim of the Network is to deepen understanding in science, medicine and education by fostering both rational and spiritual insights in a spirit of openness, rigour, sensitivity and responsibility. Details available from the office:

Scientific and Medical Network, Lesser Halings, Tilehouse Lane, Denham, Uxbridge. UB9 5DG. Tel/Fax: 01895 - 835818.

BOOK REVIEWS

Percy Seymour, *The Paranormal: Beyond Sensory Science* (Arkana Penguin Books, 1992, £6.99, 184pp., ISBN 0 14 019305 7).

I recall a Trivial Pursuit question which asked what belief system was refuted by a large number of Nobel Prize scientists. The answer was 'astrology'. The author of this book is one of the small band of scientists who is prepared to take astrology and other phenomena, which are often referred to as the paranormal or parapsychology, as serious subjects for scientific research. He is an astronomer and physicist and is currently a principal lecturer in astronomy in South Wales.

The title of the book is somewhat misleading for less than one half of it is taken up with discussing the paranormal. The author's purpose is summarised in the epilogue as "... an attempt to reconcile, at least within my own mind, the fundamental conflict between the theories of relativity and quantum theory. Like all theories it is speculative, but it is underpinned by a mathematical framework, and so, with further developments and calculations, it will lead to results that can be tested against observations and experiments ... It also shows that it is possible to bring some phenomena, which up to now have been dismissed as paranormal, into the realm of scientific explanation." (p. 175) Thus most of the book is taken up with a discussion of modern physics and especially forms of communication. There are valuable sections on how the senses work and how personal time is related to space-time. The author is particularly keen to develop a theory of cosmic 'memory' which can account for the paranormal events that he later discusses. This theory takes the form of a world-line web in which particles, that contain information from past interactions with other particles (the outworking of Bell's Theorem) influence the thoughts and actions of human beings and other organisms. It bears some relationship to the theory of morphic resonance developed by the maverick biologist Rupert Sheldrake, whose work is reviewed in a recent edition of this journal (*Faith and Thought* Bulletin Number 17 - April 1995). Seymour is aware of this and shows how his views diverged from those of Sheldrake.

Turning specifically to the paranormal, Seymour applies his theory to astrology, telepathy and clairvoyance, apparitions, precognition, retrocognition and homoeopathy. He is particularly interested in the work on twins, especially where it is claimed that identical twins, even those separated at birth, have died or given birth at the same time, or who seem to feel one another's pains. He also finds surprising parallels with astrological twins, that is children of the same sex, who are born at the same time but unrelated, and planetary twins, who are those born when the same planets are in the same sector. He claims that it has been established that those from specific occupations such as doctors, politicians, actors and sports personalities are connected by being born under the same planet. He argues that not only is an individual's neural network wired up with instructions from the genetic code, which will the same in the case of identical twins, but also responds to the frequencies of the world's geomagnetic field. The influence of this field is interrupted by 'noise' as are badly-tuned radio stations, but at moments of intense emotional or physical pain or trauma, as for instance the death of someone close, then the communications channels are clearer. This, he believes, accounts for apparitions of the dying. Because the world-line web passing through a place is continuous with past events then it would be possible to pick up resonances from people who left an imprint there (ghosts) and this might be stronger if the person perceiving it was related to either the place or the person whose apparition is seen. He believes the success of homoeopathy, which

relies on extremely diluted mixtures of drugs, can be accounted for by the storing of magnetic memories in the liquid. The electrons will vibrate in a pattern characteristic of the chemical and will impose a pattern on the world-line web which can be communicated to water molecules in which the chemicals are dissolved.

The author admits that in certain areas the evidence is very tentative. For instance he says, "Since many of the people who will enter certain professions and reach the top of their chosen profession will have similarities in their birth charts, it is quite likely that they will react in similar ways to subsequent positions of Sun, Moon and planets. Thus there may well be patterns in certain events involving decisions by people in command. However, the evidence in this area is, at the moment, very tenuous, so the claim that it is possible to predict the future occurrence of such events is not really justified, although it may well be possible to indicate the likelihood of their occurring. This is a part of astrology that needs much more vigorous research." (pp. 163-4). I am of the opinion that the other controversial claims in this book equally required a good deal more vigorous research before they will be accepted. I would nevertheless commend this book as a useful summary of current research and as a stimulus for further reading for those interested in this fascinating area.

R.S. Luhman

Christopher Ray, *Time, Space and Philosophy* (Routledge, London and New York, 1991, 268pp., PB £10.99, ISBN 0 415 03221 0 and 03222 9 [PB])

This book provides an excellent introduction to the properties of space and time and of the many mysteries surrounding them. There are good, non-technical descriptions of special and general relativity, of Mach's principle, of the curiosities of time travel and of big-bang cosmology, all written at a level suitable for readers not trained in physics or mathematics. The sections I found the least satisfactory were the more philosophical ones. Since the author is an Assistant Professor in the History and Philosophy of Science (at Portland State University), this is perhaps strange. Maybe the explanation lies in a prejudice of the reviewer against the sort of philosophy that tries to make generalisations about what science is and about what scientists do, rather than to discuss the actual science; maybe it is partly because in some cases I thought there were a lot of words with not too much content (for example, I wonder why there was so much emphasis on the so-called "Zeno paradox"); certainly at times the author's insistence on being balanced meant that there was a lack of critical comment on the variety of views that were being discussed. Sentences like "Laws do have a role in science, but this role is in the context of science as a whole" (p. 227), should convey something to which I should react, but I do not know what they are supposed to mean. When a high-energy experimentalist uses the law of conservation of energy to help him calculate the machine energy required to produce a given

particle, does he, or should he, recognise this alleged restriction on the role of the law, or be concerned that Cartwright thinks that the law cannot be true?

Ray regards the fact that scientists keep changing their minds as a major obstacle for the philosopher (p. 217). I suppose scientists would regard it as one of the reasons why the pursuit of science is so rewarding. When we no longer learn new things, it might mean we already know the answer to all questions. I fear, however, that is this were to happen, it would be more likely to mean that we have lost interest!

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K. E. Drexler, C. Peterson with G. Pergamit, *Unbounding the Future: the Nanotechnology Revolution* (Simon and Schuster, 1992, 304pp., HB., £16.99, ISBN 0 671 71108 3)

The host of man-made artefacts with which we are surrounded, whether polymers, computers, machinery, drugs etc., are fabricated "from the top down". a silicon chip, for example, is first purified in bulk, then modified with controlled amounts of dopants, then etched chemically or electrochemically, then cut into small wafers, and so on. Each stage involves manipulating matter in bulk (viz. many billions of atoms at a time), with the consequent need to rigidly optimise operating conditions to give an acceptable yield of the desired product, with inevitable losses of material and unwanted side products.

Unbounding the Future is about designing and actually synthesising materials "from the bottom up" - that is, the chemist/physicist, for example, will put together a molecule literally atom by atom, to give any desired structure and properties. An indication of the ability to manipulate individual atoms appeared in a photograph reproduced in a number of journals and newspapers in recent times, of the IBM logo formed from 35 atoms of xenon on the surface of a nickel crystal at a temperature near absolute zero.

The authors argue that, although such technology is in its early infancy, now is the time to begin to understand the revolutionary implications. A nanometre is 10^{-9} metre, and of the order of atomic dimensions: hence 'nanotechnology'.

Nanotechnology will, it is claimed, revolutionise medicine, engineering, control of pollution and of the environment, warfare, industry, society and indeed life on earth. Pollution, disease and poverty all stem from the poor control of the structure of matter. Crude 20th century technologies will be replaced by 'thorough and inexpensive' control of the structure of matter. Not much is said about the rate at which these molecularly engineered materials might be made. A humble teaspoonful of water comprises about 10^{23} (one hundred thousand billion billion) molecules. To count such a number continuously, at the rate of 10 per second, would take far more time than the estimated age of the universe.

However, Drexler is confident these capabilities can be attained within our lifetime. The idea of molecular nanotechnology is now about as well accepted by scientists and engineers as was that of travelling to the moon in the pre-space age year of 1950, seven years before the shock of 'Sputnik'. With more widespread understanding, political decisions are more likely to serve the common good, he maintains.

The book is interesting and challenging, although somewhat repetitious. It has an index, a glossary and material for further reading, including some technical articles and papers.

D.A. Burgess

M. O. Wise et al. (eds.), *Methods of Investigation of the Dead Sea Scrolls and the Khirbet Qumran Site: Present Realities and Future Prospects* (Annals of the New York Academy of Sciences 722, New York, 1994 xiii + 514 pp.)

Reading this volume of twenty-six papers presented at a conference held in 1992, readers may deduce that present realities are few and future prospects are confused. The printed discussions show wide areas of disagreement, with one participant calling another's views 'nonsense'. Those are the ideas of R. Eiseman who argues for a strong link between the Scrolls and the early church, asserting that the Scrolls are the only texts that truly represent the situation in first century Palestine and pressing some similarities with New Testament language to show the link. Another controversial paper opens the volume: R. Doncast and P. Donerel-Voute summarise their work of preparing to publish in full the excavations R. de Vaux made at Khirbet Qumran (1951 - 1956). Rather than a monastery, they interpret it as a villa with quite lavish decoration and a purpose - built *triclinium* (dining room). A separate study of the pottery (by J. Magness), however, suggests a heavy preponderance of heavy utilitarian ware, some locally made. Intensive exploration of the caves where the Scrolls were found, and a few others, has yielded some Roman pottery and arrowheads, a juglet of balsam oil, but no more manuscripts (J. Potrich). The volume contains numerous studies of aspects of the Scrolls, some of them quite technical, some debating their inner-relationships, some their significance. A report on Carbon 14 dating produces a range from the fourth century B.C. to the first century A.D. for Dead Sea Scroll fragments, a range which some scholars then attempt to refine by palaeographic dating, a highly debatable process. This volume displays the complexity of Dead Sea Scrolls studies today and the varying points of view, mostly extremely hypothetical, which are vigorously upheld.

Alan Millard

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