PERSPECTIVES on Science and Christian Faith

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In this issue . . .

"The fear of the Lord is the beginning of Wisdom."
Psalm 111:10

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Perspectives on Science and Christian Faith

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MANUSCRIPT GUIDELINES

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Passing the Torch

Wilbur Bullock has been an active member of the American Scientific Affiliation for forty years. He has served on the Executive Council, participated in Annual Meetings, and supported the activities of the New England local section. Over the last six years he has been the Editor of *Perspectives on Science and Christian Faith*. Wilbur has carried out this task with a firm hand and a sensitivity toward both reader and author. While continuing and expanding the traditions of our journal, he has developed an effective core of manuscript reviewers with a view to providing articles which attract as well as inform the reader. Though Wilbur has taken a strong editorial stance on occasion, he has encouraged comment on all sides of an issue. We thank Wilbur for these years of service to ASA and welcome him to the journal's Editorial Board.

We also note that Russell Mixter has retired from the Editorial Board. Russ has served the ASA from the earliest days, including a stint as Editor of this journal. His contributions to the ASA and distinguished teaching career at Wheaton College have been a model for all of us.

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This issue offers a diverse range of papers. I encourage you to take the time to read them and respond with a letter to the Editor or an article which will broaden the discussion.

D. Gareth Jones offers a Christian bioethical perspective designed to counter "failures in the system," such as those which led to recent medical scandals in Australasia. These case studies demonstrate the "minefields" present in current medical advances.

Robert Fischer deals with the perennial question of the length of time involved in the "creation period." He argues that both scripture and nature point to an ancient earth whose creation "days" were longer than 24 hours.

Marvin McDonald offers the second half of his discussion on "hierarchy theory." In this paper, he examines the fruitful use of levels concepts in science-Christianity relationships by Richard Bube and Donald MacKay. He concludes with helpful suggestions for further expansion of hierarchy approaches to questions where dialogue has been difficult or where scholars from diverse disciplines must join together in attacking a problem.

John Armstrong provides historical perspective on the thinking of William Buckland, an Anglican priest and Reader in Mineralogy and Geology at Oxford during the first half of the 19th century. Buckland was a pivotal figure in a period of transition from "Mosaic" to "scientific" geology. Armstrong suggests that Buckland's thinking is much more in tune with an evolutionary framework than that of modern-day "creationists."

The Editor reports on the state of science-faith dialogue in Western Europe, a region whose roots are being shaken by political and economic changes which portend a new face for lands divided by an "iron curtain" for four decades. Christianity-science discussion is found in many quarters, with a depth and diversity generally unknown to North Americans. ✤

JWH

Contemporary Medical Scandals: A Challenge to Ethical Codes and Ethical Principles

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Two recent medical scandals in Australasia are used to highlight what may happen when important fundamental ethical principles, such as informed consent, peer review, and patient autonomy, are overlooked. Ethical codes formulated to guide the medical profession are assessed, and are found to be less useful than frequently assumed, on account of the increasing sophistication of modern medicine and of changing patterns within society. In exploring ethical principles of value, both absolute and consequentialist principles are seen to make a contribution to ethical decision-making. The first-order principles of significance are justice and love, with important second-order principles including doing good and not harm, respecting the autonomy of people, and telling the truth. A Christian contribution to bioethics lies principally in its imparting meaning to human life, in the limitation it places on scientific technique, and in the control it advocates over biomedical technology.

Recent Medical Scandals

I should like to commence with two examples of recent scandals in medical circles. These are by no means unique, and it would not have been difficult to have chosen various other illustrations.[1] The two I have chosen are of particular interest to me, since they both occurred in Australasia, although their relevance is not limited to any particular part of the world. Both caused a considerable stir within the medical profession and a furore within society. The Australian example I shall use is the Chelmsford "Deep Sleep" Therapy affair in New South Wales,[2] and the New Zealand example is the Cervical Cancer Inquiry at National Women's Hospital in Auckland.[3]

1. Chelmsford "Deep Sleep" Therapy

Chelmsford was a private psychiatric hospital in Pennant Hills, New South Wales (NSW). Over the period 1962-1979, a form of "deep-sleep" treatment was employed. This treatment consisted of continuous barbiturate-induced comas for up to four weeks at a time. Deep sleep therapy was administered for everything from pre-menstrual tension to obesity, including depression, tension, schizophrenia, and drug addiction. It is not, strictly speaking, a therapy, since it induces a deep coma following the administration of very high doses of barbiturates. As a result there is a loss of bowel control, and an inability to remove secretions from the bronchi and lungs. During this treatment, electroconvulsive therapy (ECT) was administered, sometimes in repeated doses.

Over this 17-year period 26 people died. These deaths were due to a number of causes, of which pneumonia was a principal one. Other causes included heart attacks and strokes. Fifteen other

patients committed suicide following the treatment. Additional consequences of the treatment included: loss of weight, paralysis, respiratory and bowel problems, loss of self-confidence, personality changes, drug dependence, and alcohol problems. Not surprisingly, many lives were subsequently shattered.

Patients were referred to the hospital by general practitioners and solicitors. No consent was sought for much of the treatment undertaken, and ECT was not mentioned to patients. Some were actually told there would be no ECT. No visitors were allowed. The doctor in charge of the hospital committed suicide himself on 8 September 1985. At the time of his death his medical record was clear, since no disciplinary action had been brought against him.

In 1970, the NSW Department of Health was tipped off about deep sleep therapy, as a result of an anonymous letter sent to the Department. It subsequently transpired that this had been written by a nurse who had worked at Chelmsford. However, the Department decided against investigating the hospital or the clinical appropriateness of the treatment, since it was the subject of a police investigation at the time. The result was that this form of treatment was allowed to continue.

In 1973, an individual by the name of Mr. Barry Hart entered Chelmsford to look around. According to his account, he was given a glass of water and a tablet, after which he was in a coma for 14 days. When he woke he was confused, hallucinating, in pain, and very angry. He also had pleurisy, a deep vein thrombosis, and a pulmonary embolism. He was transferred to nearby Hornsby Hospital, where he recovered over a two-week period. As a result of this succession of events, he became a crusader against one of the doctors administering the treatment. Prior to his admission to Chelmsford, he had quite specifically refused to consent to ECT, but it was nevertheless administered during his barbiturate-induced coma. At the end of 1973 he started court proceedings, but for a number of years failed to get anyone to take his story seriously. Finally he succeeded, and his case reached court in 1980. This resulted in his being awarded $60,000 (Aust.) in damages.

Five years after Mr. Hart's episode in the hospital, the then NSW Attorney-General started a campaign against Chelmsford. He failed. So, too, did campaigns started by the Citizens Committee on Human Rights (Church of Scientology), and a local branch of the Australian Labor Party. In the same year, 1978, the then Minister of Health in NSW directed the NSW Health Commission to drop all investigations into Chelmsford Hospital, on the grounds that the police were also making enquiries. Although two inspections of the hospital were actually carried out, in 1978 and 1979, there was no investigation into the clinical appropriateness of the treatment.

In 1979 the treatment was discontinued, mainly because doctors refused to send patients there. It had nothing to do with official action of any kind. The instigator of the change was a psychiatrist, who visited Chelmsford towards the end of 1978, since he had heard of the condition of patients reaching Hornsby Hospital from Chelmsford. He began to withdraw patients; as did other doctors.

Of various further developments in the 1980s, I shall highlight just one set of responses to the affair, as reported by the *Sydney Morning Herald*. Sir Martin Roth, former Professor of Psychiatry at Cambridge University in England, wrote on 6 January 1981: "The inhumanity and cruelty to which patients appear to have been subjected is quite unique in my experience, and the Scientologists and other organizations will have obtained ammunition for years or decades to come. There is therefore a pressing need for maintaining strict confidentiality

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at this stage, until one can set these barbarities in the context of contemporary practice in psychiatry." This was written in a letter received by a medical practitioner, Dr. John Sydney Smith, after the latter had attempted to generate support to achieve a substantive inquiry into Chelmsford. Sir Martin advised Dr. Smith not to write an open letter to the Royal College of Psychiatrists in Britain, but instead to send a private letter to its president.

Smith wrote to the Royal Australian and New Zealand College of Psychiatrists on 10 October 1980. On receiving no reply, he re-sent the letter. He eventually did receive a reply from its president on 16 July 1981. In this he was informed that no action could be taken until he sent $10 (Aust.): "I am unable to refer to the committee the complaint from Dr J Sydney Smith, as it has not been lodged in the manner prescribed by the Act, i.e. with a deposit of Aust $10." The College never lodged the complaint.

One of the major issues raised by this series of events, therefore, is why the medical profession and government failed to bring these appalling happenings to a halt. In the end it was left to journalists, with a series of articles in the *Sydney Morning Herald*, to bring the details into the open and to precipitate a major inquiry into these disastrous past events.

2. Cervical Cancer Inquiry

From August 1987 to August 1988 a judicial inquiry took place in New Zealand into the treatment of carcinoma *in situ* (CIS) of the cervix at the National Women's Hospital in Auckland. The inquiry was set up after a magazine article, entitled "An 'Unfortunate Experiment' at National Women's," alleged that an experimental research program had been undertaken at the hospital involving the study of the natural history of CIS of the cervix by withholding conventional treatment from some patients. The authors of the article further alleged that an internal inquiry, set up after criticisms of the program by two hospital doctors, had been a "whitewash" and that there was no evidence that the research and the withholding of conventional treatment had ever formally ceased.[4]

These allegations resulted in the setting up of a Committee of Inquiry led by Judge Silvia Cartwright.[3] At the public hearing, further claims were made, including allegations that vaginal smears had been taken from more than 2,000 newborn babies, as part of the same research, apparently without the knowledge or consent of their mothers; that a randomized controlled trial of treatment for invasive cervical cancer had been undertaken without the consent of patients; that groups of students had carried out vaginal examinations of anesthetised women without their consent; and that postgraduate students had inserted and removed IUDs on anesthetised women prior to hysterectomy, again without their consent.

[Judge Cartwright] concluded that the National Women's Hospital ethical committee procedures were inadequate and lacked impartiality. In view of this, the judge recommended that the ethical committe be disbanded.

The investigations leading to the magazine article were made by two feminists; a journalist (Sandra Coney), and an academic in the area of women's studies (Phillida Bunkle). The starting point for their investigation was a 1984 paper recording the apparent outcome of the study.[5] Two of the authors, W.A. McIndoe and M.R. McLean, were the doctors who had criticized the program as early as 1973. In this paper, the authors reported on 948 patients with CIS of the cervix diagnosed histologically between 1955 and 1976 and followed for 5 to 28 years. One group of patients continued to produce abnormal cytology consistent with cervical neoplasia after initial diagnosis or treatment. Among this group of 131 women, 22% subsequently developed invasive cancer of the cervix or vaginal vault. Among the other 817 women who had normal cytology on follow up, 1.5% developed invasive cancer.

Coney and Bunkle alleged in their article that these results were part of a study initiated by Associate Professor Herbert Green in the mid-1960s which involved following women with abnormal cytology after a diagnosis of CIS. Some women were diagnosed by colposcopically directed punch-biopsy and were then offered no further treatment. Other women, who had abnormal smears after cone-biopsy or hysterectomy, were also alleged to have received no further treatment. Coney and Bunkle claimed that there was no intention of curing these patients. The story of one woman, "Ruth," received particular prominence. After a histological diagnosis of CIS in 1964, up until her discharge in 1979, "Ruth" visited National Women's Hospital 34 times, having 28 cervical smears, 5 biopsies, 4 operations under general anesthetic, and 10 colposcopic examinations.

In 1985 she returned to National Women's Hospital with invasive cervical cancer.

Coney and Bunkle also described efforts by McIndoe and McLean to have this method of management reconsidered, leading to an internal hospital inquiry. They alleged that the report of that inquiry was termed a "whitewash" by the then Hospital Superintendent. They also claimed that no one could give them an assurance that the experiment had ever ended. They quoted Professor Dennis Bonham, the Professor of Obstetrics and Gynaecology, Head of the Postgraduate School, and Chairman of the Hospital Ethics Committee, as saying that the study "merged into general treatment." They also suggested that the views held at National Women's Hospital had resulted in an antipathy to cervical screening throughout New Zealand.[6]

There is little doubt that these various declarations and codes are useful. However, they are not as useful as one might think at first glance. This is mainly because they have been outstripped both by developments in medicine and by developments in society.

The inquiry was set up by the Minister of Health at the request of the Auckland Hospital Board and in response to public concern about the allegations made in the magazine article. Judge Cartwright found that a research program into the natural history of CIS of the genital tract had been approved in 1966, and that it had resulted in the failure to adequately treat a number of women with CIS. For a minority of women their management resulted in persisting disease, the development of invasive cancer, and in some cases (probably 24), death. She found that additional reasons for inadequate treatment were the failure to stop the trial as soon as cogent evidence of risk began to emerge, and the failure of some colleagues and administrators to impinge on clinical freedom and act decisively in the interests of patient safety.

She further found that the research program had included the studies of vaginal cytology in the newborn and of the histology of fetal cervices, and that the great majority of patients did not know they were participants in the 1966 trial. She concluded that the National Women's Hospital ethical committee procedures were inadequate and lacked impartiality. In view of this, the judge recommended that the ethical committee be disbanded.

The recommendations to improve the protection of patients involved in research or treatment included the appointment of a patient advocate at National Women's Hospital, the only duty of this advocate being to protect patients, and to ensure that they received full information and the opportunity to consent to all procedures in which they might be involved. Judge Cartwright also recommended the appointment of a Health Commissioner under the Human Rights Commission Act, to negotiate and mediate in complaints and grievances by patients, and to heighten the understanding of patients' rights on the part of health professionals. Yet another recommendation was the implementation of an organized screening program for the whole country.[7]

The inquiry raised a plethora of basic ethical issues, including the centrality within clinical medicine of informed consent, peer review, patient rights, patient autonomy, and doctor-patient relationships. It also questioned the notion of clinical freedom, and brought into focus the distinction between clinical practice, clinical trials, and clinical research. In doing this, it touched on the importance of an understanding of the nature of hypotheses, therapeutic and non-therapeutic research, and research protocols. Underlying specific topics such as these is the question of the place of medical ethics in the medical curriculum, and of the close interrelationship of ethics, science, and medical practice.[8]

Before leaving this case, it may be useful to enquire why the authorities acted in the way they did. Some hints are available in the literature. Green's original 1966 proposal set out to prove that CIS is not a pre-malignant disease. In subsequent years he went further than this by stating that it is a normal condition for most women, and that it is probably present from birth. These postulates appear to have become deeply ingrained personal beliefs, so much so that Judge Cartwright concluded that an analysis of Green's papers points to misinterpretation or misunderstanding of some data on his part, and on occasions, manipulation of his own data.[3]

When his stance on these matters was challenged in the early 1970s by more junior medical staff, Green's seniority and forceful personality ensured that no action ensued. Any viewpoint contrary to his own (that CIS was a benign lesion which did

not progress to invasive cancer) was ignored. Judge Cartwright concluded that he was a person with strong views, impatient with criticism, and with total confidence in his own judgement. He refused to debate questions on the management of patients directly with the pathologist and colposcopist involved in the diagnosis, and he showed lack of patience with any system that implied accountability amongst colleagues.

Criticism by his peers and medical superintendents was muted. This stemmed from their perception that the responsibility for Green's patients lay entirely with him and not them. These views, in turn, were based on the premise of clinical freedom, which prevented them from interfering with the way in which a medical colleague managed his/her patients. This appears to have had the effect of throwing a veil of secrecy around the management of patients, and perhaps of leading to disinterest in it as well. One of the hospital superintendents resorted to the concept of the individual doctor's conscience, when he referred to doctors as: "people of standing, of integrity, who are loyal to themselves and to their own consciences. ... When you take up medicine, you have it in your heart that you will do the best for the individual patients. Surely that's enough isn't it?"[3]

Attitudes such as these ran through the hospital's ethics committee. The result was that it had no clear concept of its role, and that it failed to settle its own guidelines for its work and for proposals put to it for approval. Judge Cartwright concluded that it had demonstrated no sense of responsibility to the public in providing accurate information when sought. It also lacked independence and impartiality.

Ethical Codes

These two illustrations of unethical scandals are not typical of medical practice. Nevertheless, they do serve as an introduction to the very complex area of medical ethical principles. What went wrong in these two instances? Could the tragedies have been averted? In both cases I believe they could have been. If the leading participants in these medical dramas had abided by certain fundamental principles, the subsequent courses of treatment for a large number of patients would have been quite different. Before I consider these principles, however, it is useful to look briefly at the ethical codes that guide the conduct of the medical profession.

The speed of these developments has left many people, including policy-makers, without adequately formulated views on the acceptability or otherwise of these procedures.

One has to start with the Hippocratic Oath, which stems from the 5th century B.C. In terms of this code it was the Hippocratic physician's responsibility to the individual patient that was paramount. In other words, this was a commitment to patient-centred ethics, in which the physician was enjoined to act for the benefit of the individual patient and, under no circumstances, to do the patient any harm. Commendable as this is, it marked the beginning of the benign paternalism that, until recently, characterized much of Western medicine. This was because at the time of Hippocrates, all decisions were made by doctors while patients were kept in ignorance. Quite apart from this consideration, it is also noteworthy that the code provides no guidance on how to define benefit and harm, let alone how to assess them.

A modern restatement of the Hippocratic Oath is provided by the Declaration of Geneva (1948; latest version 1983). As such, it stresses the doctor's responsibilities to his/her patients and colleagues. It also emphasizes the place of respect for human life from its beginning, although neither the implications of respect nor the timing of the beginning of human life are worked out. Neither does this Declaration deal with the best interests of *all* patients. It is, therefore, silent on doctors' obligations to society.

The Declaration of Helsinki (1964; latest version 1975) deals with biomedical research, and makes the fundamental distinction between therapeutic and non-therapeutic research. This is the difference between medical research in which the aim is essentially diagnostic or therapeutic for the patient, and medical research the object of which is purely scientific without any direct diagnostic or therapeutic value to the person subjected to the research. The much narrower compass of this code is its great advantage. The principles set forth in it are of considerable importance, and are of major assistance in determining the nature of research protocols. It is noteworthy that the Helsinki Declaration was first promulgated in 1964, in response

to various earlier medical scandals in which consent for research procedures was not obtained.

Regardless of the answers we arrive at in this case, there will be a major gulf between the complexities inherent within the application of sophisticated current medical techniques and the relative simplicities of the various codes available to the medical profession.

The Declaration of Oslo (1970) is devoted to a consideration of therapeutic abortion. Due to the diversity of attitudes on abortion and on the status of the fetus within most societies, the Declaration allows for this diversity, while ensuring the protection of patients, high standards of medical care, and the conscientious refusal of some doctors to perform abortions. This highlights the dangers of quoting either the Hippocratic Oath or the Declaration of Geneva as evidence of opposition to abortion, but remaining silent on the Declaration of Oslo which is more recent and is also far more liberal in its stance.

Other major recent declarations of the World Medical Association include the Declaration of Sydney (1968) on the definition of death, and the Declaration of Tokyo (1975) on torture and degrading treatment. In addition, there have been various codes adopted by different countries, and a variety of resolutions adopted by the World Medical Association.

There is little doubt that these various declarations and codes are useful. However, they are not as useful as one might think at first glance. This is mainly because they have been outstripped both by developments in medicine and by developments in society.[9]

Of these two developments, the *first* concerns the increasing sophistication of modern medicine. Decisions now have to be made in areas where, even a few years ago, no decisions were required. This in itself introduces quite new ethical dilemmas, such as the legitimacy or otherwise of various forms of artificial reproduction, whether or not to turn off a life-support system, the extent of treatment to be undertaken on a severely deformed infant or on an adult in a persistent vegetative state, and the use that should or should not be made of our increasing ability to predict in advance whether an individual will have, or will subsequently develop, a genetically based handicap. The speed of these developments has left many people, including policy-makers, without adequately formulated views on the acceptability or otherwise of these procedures.

The *second* reason why ethical decision-making in medicine has become so difficult stems from changing patterns within society. Radical changes have occurred since the 1950s with the recognition of factors such as patient autonomy, the need to tell the truth, and the importance of distributive justice within society. For instance, patient autonomy has led to a heightened responsiveness to the needs, wants, and rights of patients as individuals. The difficulty with this is that the expectations of the doctor and those of the patient may come into head-on conflict, perhaps on moral grounds, or simply because of the different perspectives of the two. It also has become evident over recent years that ethical decisions need to incorporate their possible impact on society, and not just on individuals within society.

Perhaps the most striking feature of both scandals is that the clinical issues were so straightforward.

The codes I have referred to do not overtly recognize the conflict between the claims of the individual against the requirements of society. Neither do they come to grips with dilemmas that arise from the different ways in which benefit or harm can be assessed, for instance, the decisions that have to be taken when contemplating an operation on a spina bifida baby to save its life. What are the child's best interests? What are the family's best interests? How is a balance to be attained between saving a life, and inflicting future suffering on that saved life? What does it mean to "do no harm" in this instance? How does one sort out the relief of pain and suffering, against the possibility of prolonging distress? Regardless of the answers we arrive at in this case, there will be a major gulf between the complexities inherent within the application of sophisticated current medical techniques and the relative simplicities

of the various codes available to the medical profession.

In an attempt to fill this gap, various statements of doctors' duties to their patients, profession, and society have been formulated in recent years. These are modern alternatives to the Hippocratic Oath, taking account of developments within both medicine and society. A good illustration is provided by the guidelines formulated by E.D. Pellegrino and D.C. Thomasma.[10] Its emphases are on the good of the patient, the doctor's obligations to be competent in his/her practice, and on the need to respect the contributions of other health professionals, to provide medical care regardless of the patient's ability to pay for medical services, to involve the patient as much as possible in decision-making, to respect a patient's own values, to maintain confidentiality except in extreme circumstances, to realize the importance of caring within medical practice, to refrain from active euthanasia, and to participate in public policy decisions thereby recognizing the importance of medical practice for society as a whole. Although this type of code of practice begins to take us further than the other general codes, there are still limitations. And so, instructive as some of these codes are, we have to dig deeper to come up with more fundamental ethical principles. Before I examine these principles, however, it may be instructive to return to the scandals with which I began.

The loss of a patient-centered ethic leads to a second loss, namely, respect for human life.

Perhaps the most striking feature of both scandals is that the clinical issues were so straightforward. Neither involved difficult ethical decision-making, neither was dependent upon highly sophisticated medical interventions, and neither was due to an upsurge of patient autonomy. Problems arose because basic patient considerations were overlooked. In neither instance was the treatment patient-centered, in the sense that the concerns and wishes of the patients received paramount consideration. These were overlooked, as the concerns of the doctors assumed prominence. The reasons for this were probably quite different in the two instances, and yet the end result was the same: the patients' welfare was subjugated to the interests of the attending doctors.

By definition, acceptable medical standards take account of the good of the patient, and this itself involves a mixture of absolutist principles and consequentialist principles.

The loss of a patient-centered ethic leads to a second loss, namely, respect for human life. While there is no evidence in either case to suggest that the doctors had a low view of human life, human life was lost as a by-product of procedures that placed the doctors' own interests (including their research interests) ahead of those of their patients. This is one of the most salutary lessons to learn from these scandals: displacement of patients' welfare to a subsidiary position in health care leads inevitably to a lowering of the value placed on human life. Once the centrality of the patient as the object of concern in health care is lost, there is a concomitant lowering of the value society and the medical profession ascribe to that patient as a human person.

One consequence of this is that the way in which the medical profession carries out clinical research reflects its view of the patient as a human person. In drawing a distinction between therapeutic and non-therapeutic research, the basic assumption is that neither category should cause harm to the patient. This is where the research conducted at National Women's Hospital failed so badly. The ignorance in which the patients were kept precluded their informed consent to the procedures that were conducted on them, and allowed procedures to be used that would (unintentionally) harm them. Their treatment in this manner was only feasible because they were viewed as incapable of, or unworthy of, making informed decisions. They were, either implicitly or explicitly, treated as unequal to the medical staff who were carrying out research on them.

These considerations highlight both the nature of the two scandals I am dealing with in this paper, and the value of the guidelines put forward by Pellegrino and Thomasma.[10] The practices in these cases failed to meet one guideline after another. They ignored the good of the patient, some of the doctors failed in their obligation to be competent in their practice, they did not respect the contributions of other health professionals (this was especially the case with Herbert Green in National

Women's Hospital), they refused to involve the patient as much as possible in decision-making, they made no attempt to respect patients' own values, and there were serious questions about whether they paid due attention to the importance of caring in medical practice.

A theological approach to the world imparts **meaning** *to human life.*

In spite of the deficiencies of these cases, even in terms of ethical codes, further progress can be made by examining ethical principles.

Ethical Principles

In the crudest of terms one can say that the specific conflict encountered in medical dilemmas is a manifestation of a more fundamental conflict, that between pure *absolute principles* (or deontology) and extreme *consequentialist principles* (or utilitarianism). Absolute principles emphasize the inherent rightness or wrongness of actions, whereas utilitarian principles stress the consequences of actions.

The difference is nicely summed up by an illustration provided by Professor Richard Hare:

> Absolutists will say that because killing innocent people is always wrong, if you are in a situation in which if you do not kill one innocent person twenty other innocent people will die (though not by your hand) then you ought to be prepared to let the twenty die rather than become guilty of the death of one. But utilitarians will say that you have to act for the best in the circumstances, and save the twenty at the expense of one.[11]

A more specific medical example might be provided by the concept of the sanctity of human life, a concept that is referred to repeatedly within Christian circles. In terms of a pure absolutist view, one would be obliged to try and save every single life from extinction regardless of the enormous costs, and of any consequences this may have for other patients. On the other hand, an extreme utilitarian approach may advocate the destruction of handicapped people on the grounds that this was in the best interests of society as a whole, since the quality of life of most fit people would be improved by such a measure.[12] It is difficult to defend the purist version of either position, since both lead to the neglect of patients—those with whom we are not currently concerned in the case of the absolutist, and those who are handicapped in the case of the utilitarian. Both have negative effects for patients for whom the medical profession should have a caring and healing duty.

In practice, the two principles co-exist within society, and most—if not all—medical practitioners (including Christians) utilize the two principles. This is because each approach has its inherent advantages and disadvantages.[13] For instance, the strengths of consequentialism stem from its core of realism, its readiness to assume responsibility for the effects that follow from human actions, and its emphasis on reducing the lot of human suffering. On the other hand, actions cannot be evaluated solely in terms of their consequences, while a purely utilitarian calculus puts at risk despised and unpopular minorities within society. Deontology, for its part, is valuable because rules provide crucial signposts for ethical decision-making, while some rules appear to be of very general applicability and may protect exceedingly basic values, such as human dignity. Nonetheless, rule-centered approaches also have limitations, including the way in which they may obscure more fundamental principles underlying the rules, in cultural terms rules are sometimes relative, while even fundamental moral rules may come into conflict with one another.

Christian thinking imparts content to the general directions provided by bioethics, and the content is a framework for approaching the ultimate questions of our existence.

Most seek to find a middle path, in which an attempt is made to attain a balance between the two approaches. We may show very great respect for widely held rules, but at the same time we retain our options about adhering to them when confronted by difficult circumstances and what may appear as highly undesirable consequences.

John Habgood, the Archbishop of York, has summed up this middle-way within the context of medical ethics. He writes:

> To argue solely in terms of general happiness provides no safeguard against injustice towards individuals. A newborn child with severe spina bifida has little to put in the scales of a utilitarian balance, unless the sheer fact of its humanity is respected. No doubt in many cases such respect for its life will be outweighed by the potential misery the child might suffer and cause. But unless there

> is seen to be a conflict of principles at stake, not just a single principle, the gradual assumption of powers over life and death could become too easy. And the converse is also true. To assert respect for human personality, and so to preserve life at any cost without considering what in general makes human beings happy may, and often has, led to unnecessary suffering for the sake of blind adherence to beliefs.[14]

In other words, we live with conflict between principles such as these, and we experience the tension that inevitably exists between the two—in our lives, in our professional decision-making whether in the medical or allied professions, in the laws we enact, and in the outworking of all these in society at large.

The scandals with which I started raise the question of whose good is to be considered in medical practice. If the answer is unequivocally *either* the good of the medical profession *or* the good of patients, different responses will be given. This applies to both absolutist and consequentialist approaches. In both cases, it has to be decided to whom one listens. If, in these instances, the actions of the doctors are implicitly accepted, they were in the right all along. If, however, the patients are to be believed, the doctors were guilty of major errors of medical practice and judgement. In other words, some objective standard is required, and this can only be provided by the scientific and clinical standards of the profession. The doctors have to be assessed, therefore, not simply in ethical terms but in scientific terms as well.

A theological perspective places limits on scientific technique.

Were the doctors practising medicine by the generally accepted criteria of their profession, or were they deviating from this in some recognizable way? For many years, many members of the medical profession appeared to accept that they were adequate, although as time passed more came to doubt this. Ultimately, in both instances, non-medical observers and society rejected the adequacy of their standards.

Rarely, therefore, does a choice have to be made between profession or patients. The profession's own clinical standards are the primary consideration. Only when these can be established as in accordance with current expectations, does the question of absolutism or consequentialism become relevant. By definition, acceptable medical standards take account of the good of the patient, and this itself involves a mixture of absolutist principles (protecting the lives of innocent people) and consequentialist principles (acting in the best interests of patients in the present circumstances).

There is no escape from the control over ourselves offered to us by biomedical technology. My argument is that this is legitimate if, in learning to exercise such control, we seek to do it in cooperation with God.

We need now to go further and begin to tease out more specific principles that have emerged as of value within medical practice. These do not protect any of us from conflict, but they do begin to point a way forward.

In looking for what we might describe as pivotal *first-order principles*, it would appear that *justice* and *love* are crucial.[13] While there are many other important moral qualities, these are of central significance and of universal relevance, especially within a Christian perspective. Lewis Smedes has expressed this point very powerfully when he writes:

> Justice and love are absolute, unconditional, unequivocal. They are global, universal, all-embracing commands. They pin us down at every corner, grip us at the centre, allow us no qualifications or evasions. Justice and love cover every conceivable human situation. They are the be-all and end-all of the moral life.[15]

From these major first-order principles, various *second-order principles* can be elaborated. These include such principles as the following:

- Doing good and not doing harm
- Respecting people rather than using them
- Respecting the autonomy of people
- Preserving life
- Telling the truth
- Seeking not to harm innocent people
- Ensuring that the discrepancy in power inherent in a professional relationship is not exploited

All these principles enshrine moral ambiguities, and we should not expect otherwise. For instance, we only have to consider the principle of preserving

life to bring out some of these ambiguities. Existing ethical codes stress the doctor's obligation to respect life, rather than to preserve life at all costs. However, if there is no obligation to preserve life at all costs, one has to make the distinction between actively killing a patient and letting that patient die. Alternatively, one may consider invoking the principle of double effect, whereby one person is allowed to die or is killed indirectly in order to save the life of another person. There can be no escape from decision-making. Conversely, to preserve life at all costs also brings with it major dilemmas, over and above economic ones. For example, this obligation may come into conflict with the obligation to do no harm. It may also conflict with the patient's own liberty, since by refusing a request to end a suffering patient's life, the doctor may be overriding the right of that patient to choose death. It could be argued that, by refusing to participate in a patient's death, a doctor is not acting in the patient's best interests.[12] Once again, therefore, decisions cannot be avoided, and there is no escape from moral ambiguity.

What we need, from a Christian angle, is a theological matrix, within which the thinking and attitudes of Christian doctors, nurses, scientists, sociologists, and counsellors can develop.

The decision-making in the scandals I am concerned with appears to be of a different order, although the nature of the moral ambiguities needs to be assessed. In the case of the events at National Women's Hospital, it can be agreed that the experiment was aimed at doing good to the patients, since it spared many of them radical surgery. This may have justified the procedures employed in the early years of the experiment, although it has to be balanced against the principle of respect for their autonomy. The paternalism of the clinician concerned overrode the patients' autonomy, since they were not informed of the pros and cons either of the treatment being performed or of the treatment being withheld.

The lack of a convincing research protocol also impinged on the principle of doing good and not doing harm, since it did not allow a decision on this matter to be reached. By itself, the research protocol did not lend itself to any testing of the harm that was being done. There was no way of arriving at a decision, emphasizing that poor science leads to a contravention of fundamental ethical principles.

Green's unwillingness to inform his patients of the research nature of his treatment stemmed from his use of his patients and his lack of respect for them. This may not lead to obviously questionable clinical practice, or to poor clinician-patient relationships. This is where it may be deceptive, since a cursory assessment of clinical practice may fail to reveal any deficiency in ethical principles. Hence, the need for overt ethical approval of clinical research, and for some form of ethical audit of clinical practice.

Two other ethical principles were also placed at stake in this situation, and the two principles are linked. These are: telling the truth, and ensuring that the discrepancy in power inherent in a professional relationship is not exploited. It can be argued that Green did exploit this relationship and that, in so doing, he failed to tell the truth. It is not that he explicitly failed to tell the truth, but that his misuse of his authority led him to conceal clinical details he should have revealed. Herein lies the danger of such an asymmetry in power: the normal rules governing a relationship no longer apply, leading to a failure to enter into dialogue with the patient. However, not only does this apply to the clinician/patient relationship, it also applies to clinician/clinician relationships within a medical hierarchy. There is a discrepancy in power between senior and junior clinicians. This was the case at National Women's Hospital, where Green's power within the clinical establishment made it impossible for those junior to him to question his authority. This was why the complaints of those concerned at his treatment of CIS fell on deaf ears, and why the medical profession failed to control its own members. The notion of clinical freedom allows the exploitation of the less powerful by the more powerful.

A Christian Contribution to Bioethics

The perspective can now be narrowed to take account of specific Christian considerations. The immediate major one is to ask whether Christians have any particular contribution to make, or whether the principles I have already alluded to are the only ones Christians have. Can Christian theology fill out the principles I have been touching on? I believe it can, for the following reasons.

The *first* reason is that a theological approach to the world imparts *meaning* to human life. In particular, it helps us appreciate the meaning and role of suffering, pain, disease, deformity, and death; it places them within an overarching perspective of our relation to God and of God's relation to us. It helps us see them within a world of purpose, because it is a world brought into being by a purposeful and personal God. Such general principles will not immediately solve the problems *I* may have with *my* suffering or loss, but they constitute a framework within which I can begin to make sense of my own depravation.

By contrast, secular philosophical bioethics, such as I have dealt with previously, is unable to supply any comparable meaning.[16] Philosophical bioethics is valuable in that it reaches across divergent communities of belief, but it does this at the expense of supplying meaning to the suffering, debility, and death of patients. Its strength lies in assessing general ethical principles, such as the question of informed consent, or of the debate about the allocation of limited resources. Important as such matters are, however, they stop short of bestowing value upon the individual. Why *should* we place value upon individuals? This is quite a different question from asking whether we should attempt to prolong the life of patient A rather than patient B. That, too, is an important consideration, and it is one to which bioethics has a very important contribution to make. Nevertheless, it leaves us floundering if we wish to know why it is worth devoting our care, compassion and resources to either patient A or patient B.

Christian thinking imparts content to the general directions provided by bioethics, and the content is a framework for approaching the ultimate questions of our existence.[17] This does not mean that a Christian contribution will automatically provide assured answers to imponderable questions. It is not an easy escape route from some of the puzzling perplexities of bioethics. But it *is* a way forward. It tells us, for instance, that *all* human life is of significance, regardless of its value to society, its rating on a scale of physical fitness, or its mental abilities or lack of them. This does not mean that human life is never to be sacrificed for a higher good, nor that choices will not have to be made between one human life and another. Nevertheless, the broad outline painted by the brush of the Christian (theologian) tells us why human life is important and why, as a principle, it is to be valued and treated with the utmost respect.

In the *second* place, a theological perspective places limits on scientific technique.[18] It questions the value of science for its own sake, while also accepting that science is a gift from God and is essential to the well-being of society and of individuals within society. All too easily, however, we can be seduced by the *power* of scientific technique and by the creativity of technology, and all too readily the most sophisticated forms of science and technology can be taken over by powerful cultural forces that convert them into deviant forms of pseudoscience.

For Christians, the realization that each individual patient is an icon of God is a perspective we dare not overlook.

We need constantly to be on our guard, checking and re-checking the directions of all forms of modern technology. And biomedical technology is no exception, because all too subtly that which started out with the intention of enhancing human well-being may end up treating human life as little more than a means of furthering scientific knowledge.

It is for this reason that an emphasis on the person as a being of *intrinsic* worth (that is, a worth derived from God), as an end in himself or herself, is one of the profoundest gifts that Christian thinking can bestow upon medical ethics.[19] Closely associated with this emphasis is the concept that each human being is made in the image and likeness of God, thereby transforming social worthlessness into spiritual worth. While these principles do not tell us precisely *what* to do in specific situations, they provide us with the tools for discovering what the ethical alternatives are and how one set of ethical possibilities might be weighed against an apparently conflicting set of possibilities.

The *third* area to which Christians should be making a major contribution is that of the question of the *control* of biomedical technology. The scientific knowledge of causes leads to power over those causes, and power can be wielded for human good or it can lead to human degradation.[20] The question we have to answer is: What basis is there for deciding that the welfare of an individual person will be upheld while that individual's genes, gastrointestinal tract, or neocortex are being manipulated?

There is no escape from the control over ourselves

offered to us by biomedical technology. My argument is that this is legitimate if, in learning to exercise such control, we seek to do it in cooperation with God. We have been given responsibility for human life, and it is in this onerous responsibility that we begin to experience what the freedom to be human actually entails. This is a deeply Christian emphasis, since it brings us not only face-to-face with sin, failure, self-centeredness, and errors of judgement, but also with forgiveness, grace, mercy, and love.

Looking For Guidelines

The complex multifaceted nature of bioethical issues poses a problem for Christians, who are used to looking to the Bible and to theology for answers to ethical questions. Although this basic principle is not abrogated in the bioethical area, it has to be asked what sort of answers we expect theology to provide.[17] We may expect *precise answers* telling us how to act in relation to individual patients. Alternatively, we may expect *general directions*, providing us with an overall framework within which to assess the situation of individual patients. The type of answer we expect may prove crucial, since it may lead on occasions in different directions. Even more important: which approach is more helpful in real-life medical decisions?

I have argued elsewhere that there are no specific biblical answers to questions regarding the ethical legitimacy of proxy consent for an operation on a neonate, or the ethical implications of heart transplantation units.[17] Neither do I think that theologians are equipped to tackle such questions in isolation of the contributions of others within the Christian community. What is of far greater importance is to discover appropriate general biblical and theological principles, such as the importance of the individual, justice in health matters, and the need to protect the weak and helpless. Themes such as these are critical, and it is these that we should be seeking when attempting to sort out bioethical guidelines.

What we need, from a Christian angle, is a theological matrix, within which the thinking and attitudes of Christian doctors, nurses, scientists, sociologists, and counsellors can develop. I become wary, however, when general principles are put forward as though they are specific directives of relevance to every individual in every situation. There is a difference between the general principle that "I am in favour of preserving human life," and the specific decision about what I am to do in *this specific* situation *now*.

In theological terms, many long for certainty and for unequivocal guidance over what to believe and how to act. We also expect this guidance to remain unchanged from one year to the next. In so many instances, though, this guidance has been worked out over a prolonged period of time which, in some instances, extends to hundreds of years. We cannot expect similar firm guidance on matters which, in some cases, have only been debated for four to five years—and sometimes over matters that have never been debated at all. It is in this context that uncertainty or even a change of viewpoint on some detailed bioethical matter may be quite acceptable; it may not be a mark of unfaithfulness, but rather of openness to a growing understanding and maturity within the Christian community. We are all learning, and we must be prepared to admit this.

These are crucial matters for Christians, since they so easily lead to division within the body of Christ. However, they also need to be seen in perspective. The broad principles, on which there is little if any division of opinion, are the truly crucial ones. Adherence to these will prevent a repetition of the scandals with which this article commenced, or the many other scandals which so easily degrade medical care. For Christians, the realization that each individual patient is an icon of God is a perspective we dare not overlook.[21] It does not solve all medical ethical problems, but it is a salutary reminder that we are treading on holy ground as we interact with people in need.

General as this icon perspective is, it would have proved a major constraining factor in the two scandals I have considered. It introduces an equality between doctor and patient that undergirds all forms of treatment and all clinical relationships. It also questions important facets of the hierarchical structure of clinical practice in hospitals. From a Christian perspective, it is perhaps the major undergirding of ethical practice. ✣

NOTES

[1]For illustrations of research using human subjects, see Englehardt, H.T. *The Foundations of Bioethics* (New York: Oxford University Press, 1986).

[2]The details of this affair were revealed in a series of detailed articles in the *Sydney Morning Herald* each day over the period 30 July–6 August 1988. A Royal Commission investigated the allegations towards the end of 1988.

[3]The official report of the inquiry appeared as: Cartwright, S.R. *The Committee of Inquiry into Allegations concerning the Treat-*

ment of Cervical Cancer at National Women's Hospital and into other Related Matters (Auckland: Government Printing Office, 1988).

[4]Coney, Sandra and Bunkle, Phillida. "An 'Unfortunate Experiment' at National Women's." *Metro* June, 47-65 (1987).

[5]McIndoe, W.A., McLean, M.R., Jones, R.W., and Mullen, P.R. "The Invasive Potential of Carcinoma in situ of the Cervix." *Obstet Gynecol 64*, 451-458 (1984).

[6]A more detailed account of the events leading up to the publication of the *Metro* magazine article, as well as of the inquiry itself, are provided by Sandra Coney in her book, *The Unfortunate Experiment* (Auckland: Penguin, 1988).

[7]Articles summarizing the findings of the inquiry and commenting on aspects of it are to be found in the following: Paul, C., "The New Zealand Cervical Cancer Study: Could It Happen Again?" *British Medical Journal 297*, 533-539 (1988); McNeill, P.M. "The Implications for Australia of the New Zealand *Report of the Cervical Cancer Inquiry*: No Cause For Complacency." *Medical Journal of Australia 150*, 264-271 (1989); Gerber, P. and Coppleson, M. "Clinical Research After Auckland." *Medical Journal of Australia 150*, 230-233 (1989); Campbell, A.V. "A Report From New Zealand: An 'Unfortunate Experiment'." *Bioethics 3*, 59-66 (1989).

[8]Jones, D.G. "The Cartwright Report: Significance for Medical Education." *Medical Journal of Australia*, 151, 450-456 (1989).

[9]Jones, D.G. "Bioethics: Does Theology Have a Contribution to Make?" In C. Bloor and P. Donovan (eds.), *Science and Theology in Action* (Palmerston North, New Zealand: Dunmore Press, 1987).

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[11]Hare, R. "Medical Ethics: Can the Moral Philosopher Help?" In S.F. Spicker and H.T. Englehardt (eds.), *Philosophical Medical Ethics: Its Nature and Significance* (Dordrecht: Reidel, 1977).

[12]Phillips, M. and Dawson, J. *Doctors' Dilemmas: Medical Ethics and Contemporary Science* (Brighton, England: Harvestoer Press, 1985).

[13]Higginson, R. *Dilemmas* (London: Hodder and Stoughton, 1988).

[14]Habgood, J. *A Working Faith* (London: Darton, Longman and Todd, 1980).

[15]Smedes, L. *Mere Morality* (Grand Rapids: Eerdmans, 1983).

[16]Englehardt, H.T. "Looking for God and Finding the Abyss: Bioethics and Natural Theology." In E.E. Shelp (ed.), *Theology and Bioethics* (Dordrecht: Reidel, 1985).

[17]Jones, D.G. "Bioethics—Meeting Ground Between Theologians and Non-Theologians." *Christian Arena 39* (3), 8-11 (1986).

[18]Mitchell, B. "The Role of Theology in Bioethics." In E.E. Shelp (ed.), *Theology and Bioethics* (Dordrecht: Reidel, 1985).

[19]See my two books: *Brave New People* (Leicester, England: Inter-Varsity Press, 1984) and *Manufacturing Humans* (Leicester, England: Inter-Varsity Press, 1987).

[20]Gilkey, L. "Theological Frontiers: Implications For Bioethics." In E.E. Shelp (ed.), *Theology and Bioethics* (Dordrecht: Reidel, 1985).

[21]Jones, D.G. "Ethical Dilemmas In Medicine: Some General Guidelines." *Journal of Christian Health Care 1*, 20-25 (1988).

Prayer is a powerful good. For if someone who speaks to a man about what is virtuous is seen to bear no insignificant fruit, how much greater weight of benefits will he not enjoy who engages in conversation with God? For prayer is, after all, conversation with God.

—John Chrysostom

The Days of Creation: Hours or Eons?

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As the apparent end product in God's creation, we humans seem to have an innate curiosity about both natural and scriptural things. Should God's creative days in Genesis 1 be taken to mean periods of long time (eons) or periods of short time, to wit, 24 hours? This article presents the biblical evidence for applying a long term definition to that initial and seemingly eternal stumbling block of a word: "day" in the English, or "yom" in the Hebrew. In the Bible, as in life, it's simply a matter of timing.

> In the beginning God created the heaven and the earth. (Genesis 1:1)
>
> And God said, 'Let there be light;' and there was light. And God saw the light, that it was good: and God divided the light from the darkness. And God called the light Day, and the darkness He called Night. And the evening and the morning were the first day. (Genesis 1:3-5)

Thus begins the world's greatest book. I believe it's safe to say that these words have been read by more people on earth than any other recorded words in the history of man. They are not only profound and poignant, but problematic as well.

If Moses was the author, as a consensus of evangelical Bible scholars believe, was it his intention to convey a day's period of time in this and succeeding passages in exactly the same measure as a man's day—24 hours? Or did he mean a day of God's time, which could contrast just as drastically from our simple measure as man in the flesh could be contrasted with God himself.

The entire first chapter of Genesis reveals the stages of God's creation. The first "day" begins when the sun ignites and the first dazzling light strikes the primitive planet Earth. On the second "day," the Lord divides the waters with vapor or mist in the air, and liquid covering the surface. Dry land and vegetation come about on the third "day." The sun, moon, and stars begin to function as time keepers on the fourth "day." "Day" five is devoted to creating the world's "fish" and "fowl" (sometimes translated "flying creatures," which could include insects). Land animals come on the scene, and man makes his appearance on "day" six. The Lord rests on the seventh "day."

And now for the sixty-four thousand dollar question. How many ticks of the clock took place? If we were offered the opportunity to view a video tape replay of the entire creative sequence, how much time should we budget? If we only had a week's vacation, could we fit it all in? How much time are we talking about here?

The Hebrew word "yom" used in Genesis has the same meaning as "day" does in English. It can mean the daylight portion of a day, the entire 24-hour period, or a time of undesignated length. Here's a sample sentence incorporating these usages: "In my grandfather's day the days were colder even in the daytime." Which usage did Moses intend in the first few passages of Genesis? Better yet, which usage did God intend to convey through Moses?

Many have come to believe that interpreting those creative days as long periods is a relatively modern phenomenon, necessitated by the recent findings of science; i.e., knowledge of sedimentation rates, the discovery of dinosaur fossils, awareness of a vast and expanding universe, etc. But that is not the case. Many of the early church fathers took their clues from Scripture alone in the scarcity of natural evidence. Irenaeus, Origen, Basil, Augustine and

Thomas Aquinas, to name a few, argued that the days of creation were long periods of time.[1]

There are some today, however, who are advocating that the creation days in Genesis were merely 24 hours in duration. Let's take a look at that argument. "The Biblical record itself makes it plain that the days of creation are literal days, not long indefinite ages," says Henry Morris in his book *The Genesis Record*. "If he (the writer of Genesis) wished to convey the idea of long geological ages, however, he could surely have done it far more clearly and effectively in other words than in those which he selected."

This is the rationale used by Morris:

> As though in anticipation of future misunderstanding, God carefully defined His terms! The very first time He used the word "day" (Hebrew "yom"), He defined it as the "light," to distinguish it from the "darkness" called "night." Having separated the day and night, God had completed His first day's work. "The evening and the morning were the first day." This same formula is used at the conclusion of each of the six days; so it is obvious that the duration of each of the days, including the first, was the same. Furthermore, the "day" was the "light" time, when God did His work; the darkness was the "night" time when God did no work—nothing new took place between the "evening" and "morning" of each day.[2]

The Ryrie Study Bible follows the same line:

> And there was evening and there was morning, one day. Better, "day one." Later Jewish reckoning began the day with eventide (Lev 23:32). This may be the reason for the order here, or it may simply mean that one day-night cycle was completed. Since daytime closes at evening and the night ends with the morning, the phrase indicates that the first day and night had been completed. Evening and morning cannot be construed to mean an age, but only a day; everywhere in the Pentateuch the word "day," when used (as here) with a numerical adjective, means a solar day (now calibrated as 24 hours).[3]

Not every theologian or Bible scholar believes that the first Human Being was walking around on terra firma a mere 144 hours after the "Big Bang," or whatever spectacular event that took place and resulted in a molten ball which was to finally become planet Earth. But the keys to interpretation are not found by just comparing Scripture with the world's logic, which can be faulty, or with its knowledge, which is incomplete, but by comparing Scripture with Scripture itself.

Since Moses used the word "yom" for a creative day, what was he talking about? For the answer to that question we need look no further than the Bible. Oh, we could peek at nature if we like. Just like reading a mystery novel, we could sneak to the last few pages and discover that the butler did it. We could then read the book knowing full well from the beginning who the culprit was bound to be in the end. And, I will acknowledge that the sheer abundance of scientific evidence which only permits one answer—an old earth—is a heavy persuader. But the Bible can be judged by the Bible itself. Indeed, what better measure?

Following the six days of creation and God's sanctification of the seventh day of rest, the story of Adam begins in Genesis 2:4: "These are the generations of the heavens and of the earth when they were created, in the day that the Lord God made the earth and the heavens." Here Moses used the word "day" as a coverall to apply to the previous six days of creation. But just how can one 24-hour day be equal to six 24-hour days? This is not a problem with time but with mathematics.

If a day of creation is reckoned as a time of indefinite length, then one large time of indefinite length could easily equal six smaller times of indefinite length. What happens when we slice a pie into six pieces? The word "pie" could apply to the whole or to each piece. To inappropriately apply a 24-hour period definition to the word "day" when that word has a variety of meanings, puts Scripture at odds with Scripture when it is completely unnecessary. Attempts to be literal with some passages,

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while totally ignoring other key passages, makes the Bible appear to be contradictory when it isn't at all.

Gleason Archer in his book *Encyclopedia of Bible Difficulties* reaches that same conclusion, " ... it is abundantly clear that 'yom' in Genesis 2:4 cannot possibly be meant as a twenty-four hour day—unless perchance the Scripture contradicts itself!"[4] In Hebrew, just as in English, the word "day" is frequently used for varying amounts of time. Here is a quick illustration:

A wife greets her husband at the door as he comes home from work eager for the supper she has prepared. "How was your day?" she asks.

"It was awful," he complains, "I had to work the whole day. I didn't even have time for lunch."

Ireneaus, Origen, Basil, Augustine and Thomas Aquinas, to name a few, argued that the days of creation were long periods of time.

Now is there anyone who thinks this man labored nonstop for 24 hours? Of course not, he is talking about a work day. From the context, anyone would know that his "day" lasted only eight or nine hours. It's the context surrounding the word that determines meaning, not the word taken in isolation.

William Wilson's *Old Testament Word Studies* sums up the possible variations, "A day; it is frequently put for time in general, or for a long time; a whole period under consideration ... Day is also put for a particular season or time when any extraordinary event happens ... "[5] The "days" of creation certainly do appear to be periods of extraordinary happenings which fit "a long time" definition better than a 24-hour definition.

What about Ryrie's argument that "everywhere in the Pentateuch the word 'day,' when used (as here) with a numerical adjective, means a solar day (now calibrated as 24 hours)"? Dr. J. Oliver Buswell, Jr. furnished the answer to that question as he replied to another author trying to use a similar line of reasoning:

> It may be true that this is the only case in which the word day is used figuratively when preceded by any numeral, but the reason is that this is the only case in Scripture in which any indefinitely long periods of time are enumerated. The words "aion" in Greek and "olam" in Hebrew are literal words for "age," but we do not happen to have any case in which God has said "first age," "second age," "third age," etc. The attempt to make a grammatical rule to the effect that the numeral preceding the word day makes it literal, breaks down on the simple fact that this is the only case in all the Scriptures, and in all Hebrew language, I think, in which ages are enumerated one after the other. There is no such rule in anybody's Hebrew grammar anywhere. The author of this objection, or the one from whom he has attempted to quote, has simply put forth with a sound of authority a grammatical rule which does not exist.[6]

Let's examine another stumbling block which crops up when the attempt is made to define a day of creation in simplistic 24-hour terms.

> And God said, Let there be lights in the firmament of the heaven to divide the day from the night; and let them be for signs, and for seasons, and for days and years. (Genesis 1:14)
>
> And God made two great lights; the greater light to rule the day, and the lesser light to rule the night; He made the stars also. (Genesis 1:16)
>
> And the evening and the morning were the fourth day. (Genesis 1:19)

On the first day God created light, yet the sun, moon and stars were not visible until the fourth day. How is this possible? Is something missing here? Not at all.

This presents no problem to a concept of creation which takes 16 billion years to unfold. It would be billions of years after that starting event, commonly called the "Big Bang," which would not only have created light, but heat and noise as well, before the sun would form and finally switch on to become our energy and light source. Prior to that, the earth would be "formless and void" and darkness would prevail, as per Genesis 1:2.

If a day of creation is reckoned as a time of indefinite length, then one large time of indefinite length could easily equal six smaller times of indefinite length.

One might think that in the young-earth creationist version six 24-hour days punctuated by intervals of daylight and darkness would be hard to come by since they say that the sun wasn't even created until the fourth day. But this is no deterrence if your mind is made up.

I quote Henry Morris:

> The formula may be rendered literally: "And there was evening, then morning—day one," and so on. It is clear that, beginning with the first day and continuing thereafter, there was established a cyclical succession of days and nights—periods of light and periods of darkness.
>
> Such a cyclical light-dark arrangement clearly means that the earth was now rotating on its axis and that there was a source of light on one side of the earth corresponding to the sun, even though the sun was not yet made (Genesis 1:16). It is equally clear that the length of such days could only have been that of a normal solar day.[7]

Clear? He's got to be kidding. And what does Morris mean by a "source of light on one side of the earth corresponding to the sun," but which wasn't the sun? Is this meant to be scientific? Does Morris wish us to think that God set up a kind of giant spotlight or an enormous laser beam to light up the earth for 72 hours while He was groping for the sun's light switch? Doesn't this cast the Creator and His creation in a somewhat artificial light?

Here's one prime example of perfectly credible Scripture becoming incredible through faulty interpretation coupled with misguided literalism. If these first days of creation are periods of time of indefinite length as many theologians maintain, and not 24-hour days as some would have us believe, then the sequence of events becomes much more reasonable.

When the Lord created the heavens and the earth, the earth condensed into a fiery molten ball. Water would be vaporized as steam that surrounded the superheated globe. Although the sun, moon, and stars were all in place and functional, the dense clouds would have obscured their view.

To inappropriately apply a 24-hour period definiition to the word "day" when that word has a variety of meanings, puts Scripture at odds with Scripture when it is completely unnecessary.

We have no way of knowing when the sun became ignited, but certainly the sun's energy would have been called on to provide the necessary photosynthesis for vegetation which occurs on the previous or third day. Finally, the earth cooled down to where the water vapor contained in the atmosphere condensed, whereupon the sun, moon, and stars then shined through.

Gleason Archer comments:

> Genesis 1:14-19 reveals that in the fourth creative stage God parted the cloud cover enough for direct sunlight to fall on the earth and for accurate observation of the movements of the sun, moon, and stars to take place. Verse 16 should not be understood as indicating the creation of the heavenly bodies for the first time on the fourth creative day; rather it informs us that the sun, moon, and stars created on Day One as the source of light had been placed in their appointed places by God with a view to their eventually functioning as indicators of time ("signs, seasons, days, years") to terrestrial observers. The Hebrew verb "wayya'as" in v. 16 should better be rendered "Now [God] had made the two great luminaries, etc.," rather than as simple past tense, [God] made.[8]

Whereas the Hebrew verb used in previous and following passages of Genesis could best be translated "create," in this particular passage a different form of the verb was used which comes closer to meaning "made" or "had made." This makes good sense. The Lord created heaven and earth on day one, but on day four He caused the light from those heavenly bodies to be seen. How? He just parted the clouds.

If these first days of creation are periods of time of indefinite length as many theolgians maintain, and not 24-hour days as some would have us believe, then the sequence of events becomes much more reasonable.

Let me point out one significant problem that has been largely overlooked by Bible scholars. We, as mortals, cannot possibly envision the world as God must see it. For one, God is omniscient. Being unencumbered by the constraints of time, as we are, He knows the future. For another, God is omnipresent. As individual human beings, we are situated both in time and space. God has the unique characteristic or capability of being everywhere at once. He can be in Hong Kong, Honolulu, and Hackensack simultaneously.

When we humans speak of evening and morning we think of it as being synonymous with sunset and sunrise. That's because we, as human observers, are locked in time and space at one specific geographical location at any given time. Astronauts, when they are in orbit around the earth, are not so restricted. They see many "evenings"

and "mornings" during a 24-hour day as they watch the sun disappear and reappear over the horizon with great rapidity.

We, as mortals, cannot possibly envision the world as God must see it. For one, God is omniscient. ... For another, God is omnipresent.

From God's perspective the earth is always half in daylight and half in darkness perennially, day after day from the moment He created it until the moment of its ultimate destruction. In one respect we might say that God never sees "evening" or "morning," or maybe we could say that He sees an infinite number of "evenings" and "mornings" every single day. But, what we can't do is trap God in Jerusalem or Jericho and think that He, like each of us, is limited to one sunrise and one sunset per 24-hour period, lest we get trapped like Henry Morris and think God can't work at night.

To a human observer, which didn't appear until day six, the term "morning" could be thought of as being synonomous with sunrise. As pertains to the lower "living creatures," which began to experience life on day five, the use of the words "evening" and "morning" might be taken to mean periods of light separated by periods of darkness. But from day one to day four, God's timing alone applied unmitigated by any human or animal observations. We have no reason, whatsoever, to draw any conclusions as to what time table was in effect.

Let's examine another problem area. The fall of Satan, and with him one third of the heavenly hosts (Revelation 12:3,4), had to occur before the advent of man, or else Adam wouldn't have been led into temptation and sin.

The whole story of Satan's fall has to be pieced together from the various books of the Bible. But we know from Ezekiel 28:14-15 that he was the "anointed cherub," was "on the holy mountain of God," and was "perfect in his ways" from the day he was created until "iniquity" was found in him. His heart was "lifted up" because of his "beauty." From Revelation 12:7-9, we learn that there was "war in heaven." Satan fought against "Michael and his angels" and was "cast out into the earth."

How long a period of time was involved between the creation of this "angel of light" until his pride overcame him and he was cast down to earth? Well, barring two creations, we would have to cram the entire saga into just five or six 24-hour time periods if we were to believe in young-earth creation theory. That's kind of like stuffing 140 million years of dinosaur history into a 30-second TV commercial.

Let's skip now to the sixth creative period. At the beginning of day six, the Lord created "cattle and creeping things and beasts of the earth" (Genesis 1:24). Finally, Adam and then Eve are also created before the Lord rested on the seventh, or Sabbath, day.

Had that sixth day of creation been a 24-hour day it most assuredly would have been jam packed with activity. First, God made all the world's land animals. That's the easy part. Now, in Genesis 2:20, Adam has to name them all; that is, all "cattle, all the fowl of the air and every beast of the field." If that sounds like a large task for one day, ponder the following for a moment.

In the young-earth creationist's model, death does not occur in the world, even among the animals of the world, until Adam commits Original Sin.[9] The species of animals that exist today comprise less than 1% of what has inhabited this planet since it began. Over 99% of all the species which once roamed the earth are now extinct.

If you can get a grip on the magnitude of what a naming problem would be like with the thousands of species which are in existence today, multiply those species one-hundred-fold and then lay it on Adam just a few moments after his first drawn breaths.

So a 24-hour day is the one interpretation which is explicitly eliminated as a possibility. In the words of Augustine, they were "God-divided days," not "sun-divided days."

Why, it would be a sight to behold! Turtles and giant sloths would gallop by like cheetahs and gazelles. Adam would be chanting out names like a Tennessee auctioneer. Keep in mind, he'd also be cultivating the garden in his spare moments (Genesis 2:15). It's no wonder he would be looking for a

helper (Genesis 2:20), but it would be sure easy to see why none was found in that first day's blur of activity. And as a perfect ending to a busy day, Adam had his rib removed and a wife presented to him (Genesis 2:21-22). Now that certainly would have kept his first few hours on earth interesting.

Gleason Archer narrates:

> It must have required some years, or, at the very least, a considerable number of months for him to complete this comprehensive inventory of all the birds, beasts, and insects that populated the Garden of Eden.
>
> Finally, after this assignment with all its absorbing interest had been completed, Adam felt a renewed sense of emptiness. Genesis 2:20 ends with the words 'but for Adam no suitable helper was found.' After this long and unsatisfying experience as a lonely bachelor, God saw that Adam was emotionally prepared for a wife—'a suitable helper.' God, therefore, subjected him to a deep sleep, removed from his body the bone that was closest to his heart, and from that physical core of man fashioned the first woman. Finally God presented woman to Adam in all her fresh, unspoiled beauty, and Adam was ecstatic with joy. ... It has become very apparent that Genesis 1 was never intended to teach that the sixth creative day, when Adam and Eve were both created, lasted a mere twenty-four hours. In view of the long interval of time between these two, it would seem to border on sheer irrationality to insist that all of Adam's experiences in Genesis 2:15-22 could have been crowded into the last hour or two of a literal twenty-four-hour day.[10]

Even if a 24-hour period could be construed by stretching the imagination for any one of the first six days of creation, it wouldn't work for the seventh. Here again, Scripture would have to contradict Scripture just to fit an unwarranted preconception. The New Testament refers to the Lord in His rest continuing from the end of creation on through both the Old and New Testaments:

> Let us therefore fear, lest, a promise being left us of entering His rest, any of you should seem to come short of it.
>
> For we which have believed do enter into rest, as He said, As I have sworn in my wrath, if they shall enter into my rest: although the works were finished from the foundation of the world. (Hebrews 4:1,3)

According to Archer, " ... that seventh day, that 'Sabbath rest,' in a very definite sense has continued on right into the church age. If so, it would be quite impossible to line up the seventh-day Sabbath with the Seventh Day that concluded God's original work of creation!"[11]

So, if the seventh day, the Lord's day of rest, is a long period of time encompassing thousands of years as conclusively demonstrated by Scripture, then consistency demands that the first six days be given similar treatment—that is, ages or eons, but positively not 24-hour time periods!

In Psalm 90:4, Moses puts it into sharp perspective, "For a thousand years in Thy sight are like yesterday when it passes by, Or as a watch in the night [three to four hours]." These words leave not one shred of doubt that God's timing and man's timing are not to be confused. Nor will any simple equation rectify the discrepancy. We just have neither the information nor the brain power to figure out what His time may be in relation to our time.

Just in case we missed it in Psalms, we get another chance in 2 Peter. After the Apostle Peter declares that false prophets and false teachers will come in the last days, he makes this prophetic warning in 2 Peter 3:5, "For this they willingly are ignorant of, that by the word of God the heavens *were of old* ... "

And so, who says the earth and heavens *are young*? Those who are "willingly ignorant"! And just to drive the point home, the Apostle follows in 2 Peter 3:8: "But, beloved, be not ignorant of this one thing, that one day is with the Lord as a thousand years and a thousand years as one day." How much plainer can it be?

When authors who purport to be Bible scholars put forth an erroneous theory, which they claim is based on "inerrant" Scripture, it's biblical credibility that suffers.

Clearly, man's measurements are puny yardsticks indeed. How long is a day of God's creation? We're not told. But we are told how long it isn't! We are told specifically that His time and our time are dissimilar. So a 24-hour day is the one interpretation which is explicitly eliminated as a possibility. In the words of Augustine, they were "God-divided days," not "sun-divided days."

By way of summary let's reiterate some pertinent points:

1. The Hebrew word "yom" has a number of meanings which allow a time of long duration to be a perfectly good rendering of the word "day"

without any stretching of the credibility of Scripture.

2. If the sun's appearance is not until the fourth day, it could not have been used as a means of measuring the length of the previous three days.

3. The sixth day of creation is just too loaded with events to be stuffed into 24 hours.

4. The seventh day continues on into the church age.

5. We are expressly told, both in Old and New Testament, that God's time is not to be confused with man's time.

Why do some persist in maintaining an intransigent mindset? The days of creation, in a million years, couldn't be 24-hour days. For those who proclaim to know the Bible, they certainly have overlooked or ignored some pretty relevant modifying passages. Are these young-earth proponents simply interpretational lightweights, or is something else afoot?

I suspect the beginning impetus for the most recent surge in young-earth creationism stemmed from a preoccupation with the general theory of evolution and its atheistic overtones. Once the course was set, blinders were applied and there has been no listening to reason ever since. Young-earth creationists seem to have cast scientists into Satan's robes and will use whatever argument, spurious or otherwise, to vanquish the foe.

The case for evolution does have a principal requirement. Long periods of time are needed for species to slowly evolve from simple to more complex life forms. If millions of years are available, then some aspects of the theory of evolution could be viable. If the time required is denied, then gradual evolution becomes an impossibility and only sudden creation will work. Defeating evolution at any cost appears to have been the prime motivator of young-earth creationists, but now the helmsman has been swept overboard, vested interests have been established, and many creationists are caught up in perpetuating a wayward "ministry."

Initially the motives may have been pure, given the benefit of the doubt, but the tactics currently in use are deplorable. The Bible is made to appear to be in error while, in fact, it is these young-earth creationists themselves who do error through inaccurate interpretation compounded by their denial of a preponderance of carefully compiled scientific evidence which points in only one direction. When authors who purport to be Bible scholars put forth an erroneous theory which they claim is based on "inerrant" Scripture, it's biblical credibility that suffers. Biblical error is the conclusion! The lamentable effect is for the baby of Christianity to go right out the window with the bath water of creationism!

In light of more than adequate scriptural limitations coupled with voluminous scientific data which is totally one-sided, the burning question is: Why is young-earth creationism so readily accepted by many conservative Christians? I believe the answer is that while Bible expositors who subscribe to the young-earth hypothesis can be criticized for using flawed logic in this particular area, in other areas of Christian doctrine their theology is generally quite sound. This makes the poisoned pill easier to swallow for eager, well-intentioned evangelicals who are hungry for the Word and angered by the popularity of evolutionism.

The fallacy of young-earth creationism would be a lot easier to detect if it weren't encapsulated in what is otherwise rather commonly accepted hermeneutics. Ask any Major League pitcher and he will tell you it's the fast ball that sets up the curve.

If God's truth is "sharper than any two-edged sword" (Hebrews 4:12), then perhaps a falsehood is deadlier than any double-pointed spear. One point wounds evangelicals, impeding their effectiveness as soul winners. The other pierces the hearts of unbelievers in their rejection of the message delivered by unreliable messengers. If evangelicals can't be trusted in a simple matter such as the age of the earth, which can be easily verified, then how can they be believed on the doctrine of vicarious atonement, for example, where the corroborative evidence is far less abundant. Therein lies the tragedy. The unbeliever may remain in unbelief because the Bible is presented in an unbelievable fashion right from the first chapter.

If evangelicals can't be trusted in a simple matter such as the age of the earth, which can be easily verified, then how can they be believed on the doctrine of vicarious atonement?

The more startling irony in all this is that while many young-earth creationists have resorted to science-bashing through what they call "creation science," working scientists in their search for truth, wherever it may lead, are finding in some instances that science is taking them straight to the Bible!

The materialistic Big Bang theory has fallen on hard times. Even though most physicists readily accept the sequence of events which followed, attempts to explain the cause and origin of that giant explosion is a whole new ball game. An exciting proposition from a Christian perspective is the "New Inflationary Theory" which posits that the universe originated from nothing, as in John 1:1.

One scientist, Dr. Robert Gange, reports in his book *Origins and Destiny*:

> In the Big Bang theory, our hands were tied because we could not go back in time to the actual beginning. A small impenetrable interval of time, called a 'Planck time' separated us from seeing the true beginning. But the New Inflationary Theory frees us from this limitation and gives us a picture of the universe from the moment it unfolded. Were we to condense its implications into one sentence, it would be this: The universe seems to have come into existence out of nothing. That's right; out of nothing.[12]

Now let's see, who can create something out of nothing? You guessed it—God can! That might make a good starting point for creationists to use in their fight against evolution, if there weren't so many caught up in trying to prove that the world is young. That's what can happen when we're so busy banging the drum we can't hear the call of the bugle. In the words of Martin Luther: "The Word must stand, for God cannot lie, and heaven and earth must come to ruins before the most insignificant letter or tittle of His Word, remains unfulfilled."

I believe any thoughtful person who carefully examined the scriptural evidence alone would conclude that a day of God's creation was not recorded in such a way that it should cause us to believe those could be 24-hour days. When the tremendous amount of scientific evidence is weighed in, which convincingly underscores the case for an ancient earth, then all argument should abruptly end. The days of creation were the periods of time God took to accomplish His creative deeds. Attempts at interpreting those days as 24-hour time periods violates God's Words in Scripture and His Works in Nature, not to mention man's good common sense. ✤

NOTES

[1]Ross, Hugh. *Biblical Evidence for Long Creation Days* (unpublished), p. 1.
[2]Morris, Henry M. *The Genesis Record* (San Diego: Creation-Life Publishers, 1976), pp. 54, 55.
[3]Ryrie, Charles C. *The Ryrie Study Bible* (Chicago: Moody Press, 1978), p. 7.
[4]Archer, Gleason L. *Encyclopedia of Bible Difficulties* (Grand Rapids: Zondervan, 1982), p. 63.
[5]Wilson, William. *Old Testament Word Studies* (McLean: Macdonald Publishing Co., 1978), p. 109.
[6]Pun, Pattle P.T. *Evolution: Nature and Scripture in Conflict?* (Grand Rapids: Zondervan, 1982), p. 269.
[7]Morris, *The Genesis Record*, p. 65.
[8]Archer, *Encyclopedia of Bible Difficulties*, p. 61.
[9]Morris, *The Genesis Record*, p. 79.
[10]Archer, *Encyclopedia of Bible Difficulties*, p. 68.
[11]Archer, *Encyclopedia of Bible Difficulties*, p. 62.
[12]Gange, Robert A. *Origins and Destiny* (Waco: Word Books, 1986), p. 19.

Man, who is but a portion of Your creation, wishes to praise You. You excite him so that he may find pleasure in praising You, because You made us for Yourself, and our hearts are restless until they rest in You.

—Augustine of Hippo

Exploring "Levels of Explanation" Concepts Part II: Levels in Science-Religion Dialogue

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This paper explores some of the ways "levels of explanation" and related concepts are used by students of religion-science dialogue. Hierarchical structures of levels help formulate broad frameworks for relating religion and science. Sorting out connections between spirituality and mind-brain relations also requires well-developed levels models. Evaluating the adequacy of hierarchy theories is made more difficult and also more interesting by the divergent use of similar concepts by scholars with different world view commitments. I conclude that science-religion dialogue can benefit from paying attention to interconnections among levels of organization, levels of explanation, and levels of functioning.

In Part I of this discussion (McDonald, 1989), I suggested that scholars interested in the relations between religion and science can benefit from digging into the notion of "levels of explanation" more systematically than has been typical. By exploring work in evolutionary biology, genetics, and epistemology the applicability of levels concepts was illustrated for broad, comprehensive contexts as well as for questions focused on a boundary between levels. However, introducing literature on "hierarchy theory" absorbed the full attention of the first paper. In this paper, therefore, I will directly examine some uses of levels notions by scholars of science-religion relationships.

The central distinction from the literature on hierarchies emphasized in Part I dealt with interactions among ontic (ontological) and epistemic (epistemological) hierarchies. Though one cannot meaningfully isolate epistemic and ontic processes, focusing on their interdependence can be fruitful. Specifically, I emphasized distinctions among levels of explanation or description (epistemic focus), levels of organization or composition (ontic levels of things), and functional levels (ontic levels of processes). The interdependence of these different kinds of hierarchies is closely connected to observation processes, reflexivity, and complementarity patterns.[1]

In this paper, I will start by briefly describing the status of levels notions in discussions of science and religion. Then, Richard Bube's use of hierarchies will be examined to illustrate the broad, integrative roles of levels structures. Third, Donald MacKay's notions of levels will provide an example relating spirituality to a specific boundary between levels. Finally, I will outline a few possible directions for elaborating and applying hierarchy theory in religion-science "compatibility systems."[2]

Levels in Science-Religion Dialogue

Although there might not be a consensus on the matter, levels of explanation and related notions are popular among a wide variety of authors studying relationships between science and religion. Barbour's classic text (1966) makes use of the ideas, as do various popularizations (Bube, 1971; Capra,

1982; MacKay, 1979). Scholars from various backgrounds and predilections toward religion find valuable places in their compatibility systems for these notions (Arbib & Hesse, 1986; Campbell, 1974; Peacocke, 1988; Polkinghorne, 1986). What significance is there to an emphasis on hierarchy ideas by such a wide diversity of authors?

Perhaps the central reason for the widespread thinking about hierarchies is that levels patterns become important in the organization and functioning of complex systems.[3] The phenomena under study in science-religion dialogue definitely reflect a great deal of complexity. That complexity reflects both: (a) the broad scope of many considerations falling under the rubric "religion-science dialogue," and (b) the intricacy of specific problems like the nature and origins of life. The literature on hierarchy theory is a valuable resource for studying such patterned complexity.

Another significant feature of levels literature is that the diversity of people interested in hierarchy notions sometimes leads to quite different applications of similar ideas. Consider for the moment two cases where hierarchy theory is employed by scholars of science-religion relations working within diverse world view commitments. Campbell's (1974) classic paper uses hierarchy theory in what can be described as a "functionalist" account of religion (because the social functions of belief systems are seen as primary). Based on his account, Campbell describes one alternative to traditional values:

> Evolutionary biologists and others who are confused about the meaning of the name God can worship their Creator by worshipping the selective system that produced man, man's ecological niche. Properly approached, this could succour many aspects of man's spiritual needs now being starved under the self-worship that too often comes with loss of traditional values, and without compromising scientific scruples. (p. 184)

Campbell's naturalist commitments illustrate one framework within which the significance of levels notions is recognized, including their value in understanding "spiritual needs," values, and science.[4]

Capra (1982) works within a different framework when he considers levels concepts as fitting well with both Eastern religion and Western science. He examines several aspects of

> the notion of multiple levels of reality which differ in their complexities and are mutually interacting and interdependent. These levels include, in particular, levels of mind, which are seen as different manifestations of cosmic consciousness. Although mystical views of consciousness go far beyond the framework of contemporary science, they are by no means inconsistent with the modern systems concepts of mind and matter. (p. 303)

This statement reflects Capra's summary after having reviewed the levels of organizational complexity in biological systems. For him, compositional levels tie in clearly with levels of consciousness as understood within a mystical perspective. In general, it can be instructive to juxtapose Capra's views with Campbell's and both of theirs with the positions of Bube and MacKay discussed below. Such a contrast clearly points out the diversity of ways that levels concepts are used by scholars of science-religion relations, while also highlighting different world view commitments among these scholars.

This point is worth developing briefly. Since hierarchy notions are recognized as important by scholars with widely differing world view commitments, levels seem to reflect basic patterns of complexity in creation and/or human knowledge systems. That is, if recognition of levels is robust under a diversity of assumptions, levels structures may well be fundamental. The presence of basic patterns does not imply, however, that hierarchy models are necessarily employed in the same way by different scholars. Rather, the examination of relationships between world view commitments and

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one's manner of application of levels models promises to be a valuable project for students of religion-science relations.

In support of this claim, consider the process of identifying weaknesses or strengths in levels models. Any principles developed to evaluate hierarchy models promise broad implications given the widespread interest in levels.[5] Moreover, evaluating the adequacy of levels theories will necessitate distinguishing between ideas which are consensually adequate (or inadequate) and those which are adequate within some frameworks but not others. For example, in evaluating Campbell's hierarchy models, one can be alert to the possibility that certain features of his hierarchy model would be acceptable by most scholars of science-religion dialogue, while other features would not be congruent with alternative world view commitments. Features of levels models that are either world view-specific or world view-independent provide important clues about the function of hierarchy theory in the compatibility systems being studied.

Efforts at adequately grounding levels theories can contribute both to specific compatibility systems and to comparisions of scholars' assumptions with their hierarchy models.

By way of illustration, Campbell describes himself as a reductionist, while MacKay (discussed below; see also MacKay, 1979) sees his work as combating reductionism (called "nothing-buttery"). How are these two positions related to their respective hierarchy models and their views on science and religion? If nothing else, examining these positions suggests that levels models do not exclusively reinforce one side or the other in the classic debate over reduction-emergence. Identifying interactions between epistemic and ontic levels is one important direction to pursue in sorting out questions relating reduction and hierarchy.[6]

In short, examining relations between scholars' world views and their hierarchy models promises to strengthen the rigor of conceptualization. Consequently, one improves one's capacity to benefit from the work of other scholars, especially if there is disagreement on basic issues.

To summarize, the popularity of hierarchy models stems largely from their value in dealing with complexity. The different perspectives of authors studying the same complexities offer an important opportunity: the chance to develop significant evaluative principles for levels notions applied to models of science-religion relationships. Thus, efforts at adequately grounding levels theories can contribute both to specific compatibility systems and to comparisons of scholars' assumptions with their hierarchy models.[7]

Having briefly noted a few implications of the plurality of frameworks among scholars using hierarchy theory, I now focus our attention on two authors working within explicitly Christian world views.

Bube: On the Levels of Nature

Richard Bube (1971; cf., 1985) has discussed "levels of description" and a classic compositional hierarchy ("the structure of the world") as central to relations between science and religion. As a popular work, his main application of hierarchy notions is to organize the broad scope of his discussion of "the structure of the world." Given the advantage of perspectives gained by recent work in hierarchy theory and the philosophy of science, how can Bube's early work be evaluated as we further develop the dialogue between science and religion?

First of all, several aspects of Bube's 1971 presentation can be identified as strengths within the framework of contemporary levels models. He does in fact draw upon the "hierarchy theory" available at the time through an emphasis upon systems theory. Systems theory was then, and continues to be, an important source of levels models (e.g., Bunge, 1977a). Bube's description of part-whole relations in terms of "patterned interactions" fits with one way of describing systems properties that can clarify relationships between levels (cf., Barbour, 1966; 1988; Wimsatt, 1986). In one sense, then, revising Bube's work at this time is a task of updating.

A second strength of Bube's presentation is that he points out that God is not merely another level in the structure of the world: God indwells all creation. Thus, God is not simply present in one level in the structure of the world, but God sustains all of creation and provides the context for ultimate meaning of the world.[8]

Paying attention to levels notions can also identify areas needing additional elaboration in Bube's approach. For example, Bube addresses both descriptions (epistemic concerns) and compositional levels (ontic concerns) in his discussion, but his presentation implicitly assumes a simple one-to-one correspondence between compositional levels, levels of explanation, and disciplinary boundaries. With an additional 20 years of work addressing the interactions of epistemic and ontic processing in hierarchies, we have the vantage point to improve our consideration of these issues (e.g., Beckner, 1974; Bunge, 1956, 1977a; Salthe, 1985). For example, we can now point out that different disciplines often deal with the same levels and sometimes even with the same categories, while most disciplines deal with multiple levels within their areas of study.[9]

A second area where updating Bube's approach would be of benefit deals with reflexivity. Acknowledgement of observer reflexivity in a multi-leveled context requires an exploration of ontic-epistemic interactions (Salthe, 1985). The broad scope of a general religion-science compatibility system yields multiple threads of self-reference through both the scientific and the theological aspects of the enterprise. Most directly, such a compatibility system implicitly accounts for the personal integration of science and religion in the person or persons conducting the scholarly project.[10] Likewise, the nature of one's personal integration has significant implications for the construction of a compatibility system (cf., my discussion above; Van Leeuwen, 1988; Evans, 1989). In a popular presentation like Bube's, one would not want to detail all interconnections and circularities, but it would be misleading to ignore the issues altogether. At the very least, the reflexive element between compatibility scholarship and personal integration needs to be addressed, especially in popular discussions.

Levels concepts help to identify strengths and weaknesses of [Bube's] work for contemporary discussion, thus showing the applicability of hierarchies to broadly synthetic compatibility models.

Third, more work is needed on Bube's discussion of levels related to God, theology, and human spirituality (esp. chapters 1 & 7). What does it mean for theology to be a "higher" (or subsequent) level in an epistemic hierarchy of scientific disciplines? Bube's discussion emphasizes "inclusiveness" of theology in the sense that it deals with both the cosmos and the creator, but this form of "inclusion" is not why biology is "higher" than chemistry and physics: biology does not include all of physics and chemistry within its purview.[11] In effect, his comments about God not fitting into nature's compositional hierarchy needs to be expanded and applied further to theology's relationships with epistemic levels of scientific theory. It seems to me that a well developed hierarchy model will be needed to formulate the relations of spiritual domains with "familiar" levels of organization and explanation.[12]

In summary, Bube's discussion of science-religion relations emphasizes an inclusiveness of perspective and a breadth of scope. Levels concepts help to identify strengths and weaknesses of his work for contemporary discussion, thus showing the applicability of hierarchies to broadly synthetic compatibility models. For further illustration of hierarchy theory's applications, I now turn to the work of Donald M. MacKay.

MacKay: On Mind-Brain Relations

Puzzles associated with mind-brain connections provide a rich context within which to explore hierarchies in science and religion. The intertwining of religious and scientific concerns in brain-mind questions has been noted by Roger Sperry (1980), a prominent neuroscientist:

> At stake [in one's views on mind-brain problems] are central key concepts that directly involve fundamental convictions regarding the nature of man's inner being, physical reality, the meaning of existence, and related matters of ultimate concern. ... Perspectives in this area profoundly shape human value systems and societal decision-making and hence human destiny.[13]

To exemplify the significance of levels concepts in sorting out this domain, I will briefly discuss Donald MacKay's work on hierarchical models in neuroscience. His prominence in the areas of neuroscience, philosophy of science, and science-religion dialogue make his uses of levels notions particularly appropriate for the present discussion. My first step is an overview of selected papers to illustrate the role played by levels notions in MacKay's formulation of mind-brain relations.[14] Then, I will highlight ways that hierarchy concepts can contribute to understanding and evaluating MacKay's views.

MacKay, calling his position on mind-brain "com-

prehensive realism," claims that human beings are "a unity with logically complementary mental and physical aspects, which must be held together and reckoned with as equally real" (1982, p. 293). Basing his analysis on "information engineering" categories, MacKay distinguishes between different "levels of determination," variously labeled "levels of causal analysis," the "categorical level of [one's] question," or "levels of explanation" of a "conceptual hierarchy." He does not develop a complete hierarchy model in these discussions. Nevertheless, by pulling together scattered comments, one can identify some details of the hierarchical patterns to which he refers.

When considering human agency (the topic under discussion in mind-brain problematics according to MacKay), a physical level of brain activity precedes an informational level. The latter describes the *form* of a physical activity or a state of affairs as influences on the form of other physical activities.[15] MacKay's example of forms is the relation between the firing pattern of a cortical neuron and the spatiotemporal form of the retinal image. The informational level precedes a mental level (identified by processes of conscious human choice, for example), and a spiritual level is subsequent to the mental. These levels are characterized by mutually exclusive standpoints or categories, yielding a hierarchical version of logical complementarity between levels (cf., Haas, 1983; MacKay, 1958). So, at the heart of comprehensive realism is a hierarchical model which includes informational and spiritual functioning as well as biological and mental activity.

MacKay's contrasts of his own views with those of other scholars express the heart of his approach.[16] He sees his position as a "middle way" between the dualist (or pluralist) interactionism of Popper and Eccles (1977) and the "emergent materialism" of Bunge (1977a). He also sees his views as closely aligned with those of Roger Sperry (1980; MacKay, 1980). What distinctives come to the fore from this set of contrasts? MacKay likes to describe conscious mental activity as "embodied in" brain activity, thereby suggesting that the interaction between levels is "more intimate" than is the cause-and-effect view of interactionism, and is more complex than is the identity relation of brain and mind proposed by materialism. Although a detailed theory of embodiment was not presented in the papers reviewed here, MacKay does describe a higher level activity influencing lower level processes through constraints which shape the form of lower level activity (i.e., through "formal causality").[17] Likewise, lower levels influence upper levels largely through material or efficient causes. For example, mental activity directs (formally causes) the pattern (form) of growth in the developing brain and certain drugs (efficiently) cause certain aspects of mental activity.

The advantage of an embodiment view, then, is that "we can find a place for all the existing evidence without having to deny the completeness-in-principle of physical explanations in their own categories, or the determinative efficacy of mental activity" (1982, p. 292). MacKay sees dualism as inappropriately sacrificing the completeness of physical explanations and materialism as ignoring the causal efficacy of mental activity *per se*. MacKay's discussion clearly makes use of hierarchy concepts to distinguish embodiment from interactionism and materialism.

Close attention to levels structures in MacKay's work highlights both their central place in his approach and their value in critiquing and extending his model.

MacKay's emphasis on the "equally real" status of mental and physical activities provides one starting point for exploring the approach he offers. His discussion suggests that levels of determination form a functional hierarchy.[18] His language clearly emphasizes "mental activity" and "informational functioning" in the context of "causal analysis." In this interpretation of MacKay's views, he is championing a functional hierarchy which: (a) dualists have confused with a distinction between entities or with compositional hierarchies, and (b) materialists have collapsed into a unilevel ("reductionistic") ontology.[19] In this view, the logical and epistemological concerns emphasized by MacKay reflect this basic ontic pattern of processes. This interpretation of his stance has the advantage of fitting what MacKay might have intended when calling his stance "realism." As opposed to traditional instrumentalist or idealist emphases, MacKay probably wants to say that our explanatory systems reflect ontic patterns in some important ways, thus qualifying as a "realist" view.

The identification of MacKay's levels as a functional hierarchy becomes especially interesting when one recalls that there is a spiritual level of determination. In a well-formed hierarchy, the interactions between levels are of similar nature regardless of which levels are involved.[1] Presumably, then, all

levels of determination are "embodied" in the unitary entity: a person.[20] So the point of MacKay's oft-repeated examples about computer software being embodied in hardware is not that mental activities are at the same level as software (which is at an informational level), but that the embodiment relation is analogous or identical. Presumably, he is positing further details of embodiment when he describes the formal causal control of lower levels and the material/efficient causal control of higher levels in electronic information systems. By implication, the same principles hold for any cross-level interaction in MacKay's determination hierarchy. It is meaningful, then, to ask about spiritual activity shaping mental processes and neurological processes influencing spiritual functioning. By formulating MacKay's key notions into a more systematic hierarchical model, I claim we can see some implications of the position more clearly and are thus in a better position to critique, defend, or develop his work.

I have argued that there is a lot of work to do to adequately ground levels notions as they are used in religion-science compatibility models.

Further, focusing on levels notions helps us explore ways that MacKay's views compare or contrast with those of other authors. If MacKay envisions a functional hierarchy, it is conceivable that the functions may well expand the view of hierarchy discussed by Bube. Even if we elaborate the complexity of Bube's compositional hierarchy, he does not provide an explicit integration of functional levels. Also, Pattee's interrelation of informational and structural levels at the biomolecular levels displays suggestive parallels with the biological and informational levels discussed by MacKay (see Pattee, 1979; McDonald, 1989). From philosophical literature, it would be of interest to compare MacKay's hierarchy with functional hierarchies in process thought or Dooyewerdian philosophy (e.g., Barbour, 1966, 1988; Hart, 1984). In any event, the formulation of MacKay's views within a more systematic hierarchy model does lend itself well to the exploration of relationships between his work and that of other scholars, including those interested in science-religion dialogue.

To summarize, several points emerge from an examination of levels notions in MacKay's views on mind-brain relations. First, it is clear that hierarchy concepts are central to his formulation, particularly when he contrasts his views with those of other scholars. Second, close examination of his model of levels and of embodiment is a valuable way to elaborate and/or critique his views. One possible direction for such an analysis, emphasizing a functional hierarchy, was briefly described. Third, his view of levels in mind-brain relations is one key part of a larger picture which relates spiritual, mental, and biological realms. Unfortunately, his levels notions still require significant "fleshing out" to clarify these broader implications (cf., Cramer, 1985; Orlebeke, 1977). So, close attention to levels structures in MacKay's work highlights both their central place in his approach and their value in critiquing and extending his model.[21]

Summary and Implications

In concluding this discussion of levels in science-religion dialogue, it is helpful to highlight the nature of the task undertaken. I pointed out at the beginning of Part I that many open questions remain in hierarchy theory. Throughout the discussion I ignored important complexities for the sake of delimiting a clear focus. Such a strategy is characteristic of the issues under examination. As Beckner noted in his paper on reduction in biology:

> Discussions of the philosophical issues of ... the relations between levels of organization ... are always conducted in a context of insufficiently clarified ideas. And not only are they insufficiently clarified; they are ideas whose connections involve the most fundamental controversies of metaphysics, the theory of knowledge, and the philosophy of science. This means that when we look at the details of some reasonably definite question ... we find that the ideas we need are located at the nodes of a ravelled background web. (1974, p. 163)

Since one cannot unravel or display the entire web at once, I have had to be satisfied with a narrow spotlight focusing on a few nodes of the web. That is why I have insisted that this discussion makes sense primarily in the context of many scholars addressing levels and related notions like complementarity and reflexivity. Furthermore, the continued development of adequate foundations for religion-science compatibility systems will require programmatic attention to this web of concepts. The detailed elaboration of specific research topics (e.g., neuroscience) and the comparison among topics is one essential means of elaborating the web.

Given this backdrop, then, one can summarize the present focus on levels structures. First of all, the diversity of world view commitments among

scholars like Campbell, Capra, Sperry, Bube, and MacKay illustrates that hierarchy models serve many different approaches to compatibility systems for religion and science. Evaluating hierarchy models is a complex task which needs to take into account basic assumptions of scholars. That is, attempts at enhancing the rigor of hierarchy models involve exploration of potential connections between world view commitments and hierarchy concepts. One cannot expect to find simple, direct implications between a scholar's levels models and his or her world view commitments, even in the domain of science-religion dialogue. Nevertheless, elaborating foundations for hierarchy notions can facilitate the identification of any connections with world views.

A second summary topic for this paper can be drawn from Richard Bube's work. Evaluating his work illustrates the potential of levels notions for formulating comprehensively-oriented compatibility systems in religion and science. Further development of broadly focused compatibility models can be aided by tools from recent hierarchy theory. Even in popular discussions, one needs to connect spirituality, human reflexivity, levels of biological, social, and physical organization, and epistemic hierarchies of language and scientific theory. Systematically identifying interactions among functional, compositional, and epistemic hierarchies seems especially necessary when presenting comprehensive compatibility models for scholarly audiences.

A third set of lessons emerges from Donald MacKay's work on mind-brain relationships. His neuroscience research provided a focus for an embodiment model which was also used in a theory of science-religion relationships. His concepts of levels, complementarity, and the logic of scientific explanation generate a framework which deals with both mind-brain and spiritual functioning. Digging into the grounding of MacKay's levels notions not only identified ambiguities, but it also provided means for elaboration and critique of his views.[18] In addition, hierarchy notions helped highlight some aspects of disagreements among different scholars in the area. The pattern of complexity in these issues warrants the application of levels models. For a focal problem involving interlevel boundaries (mind-brain), elaborating our understanding of hierarchies is of value especially when the principles developed in a limited context are related to broader issues in religion-science dialogue.

In the two parts of this discussion, I have touched on basic conceptual issues in evolutionary theory, molecular biology, cognitive science, and neuroscience, in addition to science-religion relationships.

It seems likely that efforts at unraveling the complex web of issues associated with levels will continue to be worked out in the context of disagreements among scholars.

The justification for such rambling is the desire to trace a "thread" across diverse terrains. Specifically, I have argued that there is a lot of work to do to adequately ground levels notions as they are used in religion-science compatibility models. The thread running through the various examples involves interdependencies among epistemic, compositional, and functional hierarchies. If we accept the challenge of grounding our hierarchy notions, scholars of religion-science dialogue will work toward being consistent and systematic in addressing interlevel interaction, intra-hierarchy dynamics, and criteria for hierarchy identification. Most importantly, our models will not focus merely on multiple-level models, but we will strive to ground our understanding in the dynamic articulation of multiple hierarchies bridging human knowledge systems and fundamental patterns of creation (cf., Barbour, 1966; Simon, 1973). These issues are only a handful of nodes in the web of topics which interweaves science and religion, yet levels issues are central enough to merit our patient attention.

The reasons for working so hard to ground hierarchy models basically reflect the original motives for using these notions in the first place. Broad, integrative discussions in science and religion require tools for synthesizing diverse perspectives. Other questions (like mind-brain relations) seem to reflect a knot of difficulties associated with an interface between levels. The lesson of our use of levels notions over the past few decades is that simplistic hierarchies are inadequate to the task of understanding complexity in religion-science relations. In that regard, levels concepts join the rank of notions like complementarity, reflexivity, and observation. In closing, I would like to highlight a few directions for possible elaboration of hierarchy models in religion-science compatibility systems.

As noted above, hierarchy notions are closely intertwined with basic ideas like complementarity,

observation, and reflexivity. MacKay and Salthe (1985) both emphasize this set of issues. These authors' motivation for foundational work is partly fueled by disagreements among scholars in their fields. MacKay uses a formulation of levels to describe the relations of his work to that of other neuroscientists, while Salthe's work addresses debates in evolutionary theory. Disagreements among experts can reflect either the complexity of the topic or the consequences of world view commitments, among other things. It seems likely that efforts at unraveling the complex web of issues associated with levels will continue to be worked out in the context of disagreements among scholars. Such a prospect can be exciting and beneficial as well as challenging. The work of Arbib and Hesse (1986; briefly discussed in Part I) is one instance of a challenging collaboration while studying religion-science relationships. Their work shows both commonalities and differences between one scholar with atheistic and one with theistic commitments. Work of this kind suggests one viable form for cooperation among scholars with different world views. Levels notions and associated concepts are one resource to facilitate collaboration without capitulation in the context of world view diversity. One might even be so bold as to consider disagreements like these as opportunities for the pursuit of foundational studies.[22]

Multidisciplinary views are essential.

A second direction for further work implied by digging into levels notions might possibly have gone out of focus in the meandering path presented here, but it is virtually common sense among students of religion-science dialogue. That is, multidisciplinary views are essential. Most of the concerns raised here are largely designated as the domain of philosophers, and with good reason. The resources of the philosophy of science in particular play prominent roles in the issues raised here. Nevertheless, many of the authors drawn upon here are scientists who are addressing the conceptual and methodological foundations of their work. Hierarchy issues are as much substantive scientific concerns as they are problems of philosophy; or, rather, philosophical issues are as much the concern of scientists as of our colleagues in the humanities. In my opinion, everyone will be hindered if such issues are somehow delimited as the domain of only a few disciplines or scholars. For example, the full elaboration of hierarchy models in religion-science dialogue certainly requires the benefit of extensive theological reflection. And we will continue to need scholars like Donald MacKay with multidisciplinary competencies. Most importantly, the topics raised in this paper require the corporate commitment and collaboration of many scholars with diverse backgrounds and orientations and with overlapping fields of inquiry.[23]

As a final example of potential contributions from hierarchy theory, I want to mention one specific debate currently receiving attention from Christian students of science. I have focused primarily on topics in biology in these papers, largely because much of the work on levels notions has addressed that area. However, levels structures are also important for compatibility models focusing on physical or social sciences (e.g., Arbib & Hesse, 1986; Polkinghorne, 1986; Manicas & Secord, 1983). As Mary Stewart Van Leeuwen (1988) recently pointed out to readers of this journal, MacKay's work has been influential among social scientists as well as among natural scientists. MacKay's views on levels notions are, along with his complementarity notions, central to defining a "perspectival" approach to compatibility systems. It seems to me that both perspectivalists and hermeneutically-oriented scholars (Van Leeuwen, 1988; Evans, 1989) will benefit from more elaborate grounding for hierarchy models. For example, Salthe's (1985) work on observer reflexivity in hierarchical systems reflects concerns of both hermeneutic approaches (interdependence of observer and observed) and perspectival views (levels of explanation). Evans' (1977) suggestion that both persectivalist and hermeneutic ("humanizer") approaches need to be taken seriously does encourage such explorations. As seems to be the case in other debates (e.g., the point about reduction noted above), levels notions may not favour either perspectival or hermeneutic assumptions. Indeed, one can hope that grounding our hierarchy models will enhance the viability of both alternatives in addition to highlighting the nature of choices involved in selecting or synthesizing these approaches.

Levels notions are certainly no intellectual panacea, but the literature of hierarchy theory is nonetheless a valuable resource for students of constructive dialogue between science and religion. ✤

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NOTES

[1] For additional background on definitions see McDonald (1989), especially the references. It is helpful to recall that a hierarchy of levels is identified by the nature of the relationships between levels (composition is the relation for traditionally designated biological levels of organization), and by the units of analysis which define the levels (cells, organisms, etc. are units for biological levels). Thus organisms are made up of cells, etc.

[2] See Wiebe (1978), for example. For the purposes of this paper, the term "compatibility system" will be used generically for any model of relations between science and religion. Thus, attempts to demonstrate an inherent conflict between religion and science would provide a model for low compatibility. Some broader convention of this kind seems important if scholars working with different assumptions about the nature of science and religion are to clearly communicate with one another.

[3] See Simon (1973), for example. Clearly there are many conceptual tools for dealing with complexity other than levels concepts. Compare Davies' (1988), overview of complexity in contemporary science. My assertion of the value of hierarchy theory is by no means an exclusivist claim.

[4] Campbell's paper is a classic discussion of ways that higher levels influence phenomena at lower levels ("downward causation"). His brief discussion of religion is one arena in which he sees levels notions and evolutionary theory to be of value. For more discussion of his theory of religion, see Campbell (1975). As for the gender exclusive language in this and later quotes, I have not revised other authors' words even though I strive to maintain inclusive language in my own writing.

[5] In my reading, some applications of hierarchy concepts seem vague, misleading or vacuous. Moving beyond impressions to critique requires the identification of evaluative principles which have at least a minimal degree of generality. Also, questioning specific applications of levels ideas can arise as part of substantive disagreements. Debates over the contributions of MacKay's work is one example of levels concepts intertwining with substantive disagreements (cf., Cramer, 1985; MacKay, 1978b, Orlebeke, 1977; Van Leeuwen, 1988). I anticipate that systematic efforts at critiquing hierarchy formulations will bear fruit both in clarifying some debates and in sorting out complex topics under investigation.

[6] Compare, for example, Barbour (1966), Beckner (1974), Bunge (1977a), and Wimsatt (1986). In fact, one benefit of distinguishing different kinds of hierarchies is the illumination of false dichotomies in the classic formulations of reduction-emergence debates.

[7] To the extent that this work draws one into formulating principles of evaluation for compatibility systems, a metatheory of science-religion dialogue is being developed. These are among the issues which I call "foundational." Most scientists are familiar with methodological studies which are often "metascientific" or foundational in an important sense. My intention here is to simply point out that these foundational concerns are not esoteric or irrelevant. Although research scientists do not spend all of their energy on methodology, such work is an important component of programmatic research. Likewise, when we sort out relations between religion and science, the devotion of significant energy to foundational work is both appropriate and necessary for programmatic development.

[8] These comments are offered as qualification of diagrams used for illustration which simply include a "God-level" above the society level (though graphically distinguished by a double line to indicate the uniqueness of the level). Clearly pointing out that God does not merely define another level is an important starting point in exploring spirituality. It is important to go beyond the denial, however, and offer constructive formulations of the relations between God and hierarchies of creation.

[9] Beyond the disciplinary question, it is tempting to assume a strict correspondence between epistemic categories and ontic levels. After all, category errors and similar logical problems reflect one's ontology quite directly. However, the simplicity or complexity of relations between knowing and ontology depends very specifically on the epistemology and ontology in question. A one-to-one correspondence would not be possible with all ontologies or epistemologies. In my view, one of the key challenges facing hierarchy theorists at this time is to develop tools for specifying in greater detail the dynamics of ontic-epistemic interaction. In this regard, hierarchy theory requires substantive input from philosophers of science.

[10] That is, one of the questions a general compatibility system can address is whether one can participate fully as a scientist and as a member of a faith community without sacrificing the integrity of either enterprise. I submit that each scholar already embodies at least an implicit answer to that question in her or his own life. The neutrality myth surrounding scholarship is untenable, in this area of scholarship most clearly.

In a similar vein, one sometimes finds attempts to circumvent the self-reference of scholarship on science-religion relations by positing a third arena of scholarship (often philosophy) which short-circuits the circularity. For example, a simple reflexive circle might go like this: (a) science/religion (S/R) scholarship accounts for, explains, S/R relationships by developing a model of the two enterprises, including the scholarly components of their activities; (b) however, S/R scholarship is itself a scholarly enterprise; (c) thus we have scholarship developing a (delimited) model of scholarship, i.e.,. reflexive scholarship. The attempt to short circuit the self-reference involves the assertion that science/religion scholarship is neither theology nor scientific theorizing, but instead is a realm of philosophy, or some other "metascholarly" activity. This strategy harkens back to Russell's theory of types: the rule is to simply disallow certain forms of self-reference. By contrast, consider the readily established enterprises of social scientific study of the science-religion relationship on the one hand, and of the theological study of science/relgion compatibility on the other. Philosophical study does not "break" or "cut short" this loop of circularity. An infinite regress of meta-disciplines is a "solution" I find to be highly unsatisfying and artificial. In addition to the personal-professional reflexivity of religion-science scholarship, I prefer to examine the enterprise of reflexive scholarship directly instead of defining it as illegitimate in an *a priori* manner. It is not excessively difficult to start tracing some of the many threads of reflexivity in dialogue between religion and science. I earnestly invite others to join in this valuable area of study.

[11] Compare McDonald, 1989, and note 1 above regarding definitions of hierarchies. The coherence of the relationship between levels is precisely the source of power in hierarchical models. One might say that they operate as extended metaphors where, for example, the chemical-physiological level boundary is similar to the brain-mind boundary, the person-organization boundary, and so forth for each boundary in a hierarchy. Thus, the issue of consistency in inter-

level relationships strikes at the heart of hierarchy theory. Clarity and detail will be central, then, to advances in this area.

[12] Bube's discussion of "soul" and spirituality can be further extended by being placed in a more extensive levels model. Looking at his definitions of life, soul, and mind illustrate the point here: "life should be considered as a systems property in a system where the parts interact according to an appropriate pattern" (p. 145); "the word *soul* refers to the particular systems property of the totality of the life-system then active" (p. 147, original italics); and, the "property of mind is a systems property of the totality of the subsystems that make up the thinking creature" (p. 150). The importance of distinguishing and coordinating a set of definitions like these is clear. What I think needs to be accomplished in a reasonable way even for popular presentation is to briefly outline the nature of systems properties, how they interact across levels, and how different hierarchies articulate with one another.

For a recent discussion of human spirituality, see Benner, 1988. Although he does not develop a hierarchy model, his discussion of psycho-spiritual interaction and relationships fits readily into such a formulation. Many of his points in fact parallel Pattee's discussions of structure and information in molecular biology.

Levels structures are also important for compatibility models focusing on physical or social sciences.

[13] (The quote is from p. 197.) At this point in his paper, Sperry is contrasting his work specifically with other neuroscientists. However, in other work, Sperry goes much further and claims that we can "get ethico-religious values from science in a prescriptive sense" (1988, p. 610). Given the similarity between MacKay and Sperry in: (a) their neuroscience models (MacKay, 1980), (b) their convictions that these models facilitate rapprochement between science and religion (Sperry, 1988; MacKay, 1979), and (c) the importance they attach to hierarchical systems, it would be particularly instructive to explore the relations between their world view commitments and their levels models in the spirit presented in a previous section of this paper. Unfortunately, such questions take us beyond the scope of the present discussion.

[14] See MacKay (1978a, 1980, 1982). I do not make an attempt to exhaustively review his ideas partly due to the volume of his work and partly due to the narrow focus of this discussion. For other evaluations of his work, see Orlebeke (1977), Cramer (1985), and Evans (1977).

[15] For some of MacKay's statements about levels structures, see pp. 601f (1978a), p. 1390 (1980), and p. 289 (1982). His discussion of the form of activity sounds similar here to Pattee's views on genetic information: see Pattee (1979) and McDonald (1989). Also, see note 17.

[16] MacKay frequently uses levels concepts in formulating disagreements with other scholars. For another example which expresses disagreement on a different topic, see MacKay (1978b).

[17] Formal, material, and efficient causality are used by MacKay in Aristotle's sense: e.g., Book 2 of *Physics*, esp. chap. 3ff. The view of upper levels influencing lower ones through constraints or boundary conditions (shape?) is similar to Polanyi's (1968), Campbell's (1974), and Salthe's (1985), discussions of cross-level interactions, among others.

[18] The description of MacKay's views in terms of a functional hierarchy is not the only way of interpreting his use of levels notions. For example, in light of his "underspecification" notion (MacKay, 1985), he may have viewed "levels of causal analysis" as epistemic levels reflecting the cognitive limitations of human beings, or of information systems more broadly. In this case, MacKay's position is ontic monism (thus involving "equally real" mental and physical activities with descriptions partitioning reality in "artificial" ways; i.e., in ways that do not reflect ontic patterns). Of course, he might also envision both epistemic and functional features in the levels of determination—possibly while assuming a 1:1 correspondence between functional and epistemic levels. His emphasis on logic may well reflect a tight interconnection between epistemic and ontic levels structures. Also, his labels for the levels imply both ontic and epistemic features. Other possibilities exist as well. Any complete portrayal of his views in this area would necessitate broader discussion than is feasible in this paper. Nevertheless, one's interpretations of mind-brain relations can borrow or modify ideas from MacKay and benefit from his levels concepts without necessarily doing justice to the entire corpus of his work. For the present, it is sufficient to recall that the purpose of discussing MacKay's work here is to illustrate applications of hierarchy theory, not to exhaustively exegete MacKay's work.

[19] I do not imply here that Bunge (1977a, 1977b) reduces the cosmos to a unilevel structure. MacKay's objection to Bunge's materialism seems to be that calling a hierarchy model a "materialism" results in one level being assigned a stronger ontic status in some way, thus violating his principle of equal reality of levels. (I am thankful to Vaden House for highlighting these issues to me). MacKay's reaction to Bunge's work illuminates MacKay's views, even if his descriptions of Bunge are incomplete or misleading. Bunge's work is strongly steeped in systems theory, and he is in fact an important writer in contemporary hierarchy theory. Detailed description of Bunge's views would take this discussion far afield, but the interested reader is referred to his 1980 work on mind-brain relations.

[20] It is important to be clear that the term "embodiment" cannot, in MacKay's view, imply some sort of privilege or priority on physical levels. Compare note 19.

[21] MacKay's work focuses in important ways on the interfaces between physiological, informational, and mental functioning. The perspectives developed in that context also frame his work on science-religion relations. As scholars interested in religion-science dialogue work to evaluate MacKay's hierarchical models, I think his work stands as a valuable example. He clearly highlighted levels notions, but he did not, as far as I can tell, give the same systematic attention to levels as he did to complementarity, for example. Since, of course, no one can do everything, I see this point as less a criticism of MacKay than as an invitation for scholars to pursue the implications of his work, critically and constructively. For that task, greater elaboration of levels conceptualizations seems necessary.

[22] Are we ready to nurture discussions among scholars with diverse faith commitments? For example, are we willing to dedicate journal pages to this kind of dialogue? Over the long run, a series of such articles could become very instructive. ASA has already engaged in similar activities through invitations to scholars at conferences. Perhaps we can expand contacts like these into systematic collaboration along the lines of Arbib and Hesse's work while involving multiple scholars over time.

[23] Close attention to epistemic levels structures may also contribute to a framework for fruitful interactions among disciplines. Such a metatheory of interdisciplinary dialogue is another species of what has been called here a "compatibility system." After all, religion-science dialogue is primarily an attempt to explore what scientific theory and theology have

to say to one another. Generalizing this notion slightly leads to a model of interdisciplinary dialogue.

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William Buckland in Retrospect

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The Reverend Dr. William Buckland (1784-1856) profoundly influenced the historical sciences of geology and paleontology as an Oxford professor during most of the major controversies—neptunist/plutonist, catastrophist/uniformitarian, glacial, and creation/evolution. His theology remained orthodox, while his perspectives adapted to the latest developments in science. Now known as "the last of the great diluvialists," often identified with creationism, Buckland actually opposed radical "Flood geology" and represented a transition from diluvial catastrophism to modern geology, even anticipating Darwin's arguments in some important respects, through perception of progressive creation which manifested common design. He referred to "missing links" in an opposite sense to subsequent anti-evolutionary usage, emphasizing intermediate flora and fauna of past and present.

A Church of England priest whose doctorate was in divinity, the Reverend Dr. William Buckland (1784-1856) became Reader in Mineralogy and Geology at Oxford University, in 1813 and 1818 respectively (Hallam 1983, p. 41). Having studied geology with Professor John Kidd (1775-1851) during the neptunist/plutonist controversy (Faul and Faul 1983, pp. 114, 119), "the last of the great diluvialists" led mainstream catastrophism for more than a decade, through the catastrophist/uniformitarian debate. Although Buckland initially correlated geologic evidence with the Flood story in Genesis, even his earliest works (1820; 1823) recognized an immense time scale, stratigraphic column, and fossil succession. He applied the analogy between past and present processes (James Hutton's uniformity principle) to the entire planetary history, rather than only to a post-Creation or post-Flood interval. However, he considered that "diluvial" strata represented revolutionary breaks in the sequence, requiring supernatural intervention. Catastrophists assumed that massive inundations had punctuated the earth's history: events too drastic to explain by reference to observed processes. Buckland's former student, Sir Charles Lyell, insisted that natural processes at approximately present rates had to account for all strata; he called this extremely empirical view "uniformitarianism." As Henry Thomas de la Beche observed amid the arguments: "The difference between the two theories is in reality not very great; the question being merely one of intensity of forces, so that, probably, by uniting the two, we shall approximate nearer to the truth" (de la Beche 1831, p. 32; quoted by Gillispie 1951, pp. 139, 140; Hallam 1983, p. 54). Modern geology developed from the synthesis, and not from one side's victory over the other.

When Buckland wrote his Bridgewater Treatise (1836; 1837) he attributed all inundations to natural causes; he had also given up the biblicist correlation. This work's extent of appeal to supernatural agency was in the teleological argument expressed in terms of progressive creation (cf. Paley 1805, in Ruse 1988, pp. 46-49).

In 1840, Louis Agassiz convinced William Buckland that "diluvium" was best explained by glacial effects. The quaint-looking Oxford professor who wore top hat and academic robes in the field accepted Pleistocene ice age interpretation more quickly than such progressive colleagues as Sir Charles Lyell and Charles Darwin (Faul and Faul 1983, pp. 142-143, 169).

Today, Buckland's works are scarcely examined (pages remained to be split when I borrowed his 1823 and 1837 books!). Although his insights could support scientists in debates, his obsolete opinions are more likely to be quoted by creationists who advocate the radical diluvialism of Buckland's opponents from the 1820s, the "Mosaic" or "Scriptural geology" faction (Armstrong 1988, p. 155). For example, Alfred Rehwinkel cited 1823 arguments for a universal Flood, based upon Pleistocene cave deposits (Rehwinkel 1951). Buckland's objections to evolutionary theories available in his time—that they did not account for "retrograde development, from complex to simple forms," contemporaneous first appearance of diverse organisms, or co-existence of different orders of complexity (1837, pp. 293-294, 395-396)—are still applied against Darwinian views (cf. Daniel M. O'Hara's March 18, 1989 letter to Arthur N. Strahler, reporting on a British debate).

While creationists have tended to identify with Buckland and reject his colleagues William Smith and Georges Cuvier as evolutionists, his later work was much more evolutionary than anything by those contemporaries. Pre-Darwinian transition occurred during Buckland's career, reconciling biblical interpretation with historical sciences, using traditions derived from St. Augustine: these resolutions were not the later compromise presumed by Henry Morris (Morris 1985, p. 39). In fact, Darwin modified William Buckland's arguments for common design: homology (1837, pp. 201, 213-214, 233) as well as balance between predators and prey (1837, p. 293) were cited (Darwin 1859). Parallels are recognizable despite a paradigm shift, just as laminations from shale can be traced in slate.

Buckland's investigation of Pleistocene animal remains began at Kirkdale Cavern, Yorkshire, in 1821, extended to caves throughout Europe, and resulted in *Reliquiae Diluvianae* (1823). This exhaustive study earned him the Copley Medal. He distinguished "diluvium" from younger alluvium as well as older, consolidated strata, discerning a diagnostic assemblage which included mastodons and mammoths. Because Siberian examples preserved in permafrost retained woolly coats, he reasoned that these animals could have lived in a cold climate, rather than being derived from the tropics (1823, pp. 39-45). Their worldwide distribution argued for a universal cataclysm, which he then assumed to have been the biblical Flood (1823, pp. 170-177). Surmising that bears and hyenas had used Kirkdale Cavern as a den, Buckland tested his idea by importing a live hyena in order to compare such features as gnawed patterns on bones.

He realized that the only human remains which he encountered in Pleistocene or older strata represented intrusive modern burials or other later additions to assemblages. Buckland even distinguished a specimen attached to a stalagmite from a Gibraltar cave as much younger than "diluvial" fauna (1823, pp. 164-173). Absence of human evidence became one reason for catastrophists' abandonment of correlation with Genesis (Hallam 1983, pp. 51-52).

Ironically, some creationists now cite allegedly Miocene human skeletons from Guadeloupe, which Buckland understood to be modern burials probably dating from a 1710 massacre (1837, pp. 104-105; Strahler 1987, p. 472). Similarly, Carl Baugh's Creation Evidences Museum near Glen Rose, Texas boasts a supposedly Cretaceous human skeleton. One of two skeletons discovered in southeastern Utah, it was purchased from Lin Ottinger's Moab Rock Shop, and has been dated at 200-300 years (Hastings 1985, 1986; Armstrong 1989a, p. 34). Ottinger wrote me a letter on April 20, 1989, stating: "I never indicated to anyone [that] they lived in the Dakota Formation in which they were found."

The Reverend Dr. John Fleming opposed Buckland and Cuvier for attributing geological

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The quaint-looking Oxford professor who wore top hat and academic robes in the field accepted Pleistocene ice age interpretation more quickly than such progressive colleagues as Sir Charles Lyell and Charles Darwin.

phenomena and mass extinctions to the Flood, whereas the text indicated only a placid rise of waters and no monument except the rainbow (Fleming 1826). Buckland accepted the criticism, together with evidence that allegedly diluvian faunas "existed through more than one geological period preceding the catastrophe by which they were extirpated," and concluded that his postulated event was more likely "the last of the many geological revolutions that have been produced by violent irruptions of water, rather than the comparatively tranquil inundation described in the Inspired Narrative" (1837, p. 95, note). His catastrophism had been muted, aligned with actualism and removed from biblicism, before he chose glacial theory.

"It must be candidly admitted that the season has not yet arrived, when a perfect theory of the whole earth can be fixedly and finally established, since we have not yet before us all the facts on which such a theory may eventually be founded," Buckland wrote, "but ... we have abundant evidence of numerous and indisputable phenomena, each establishing important and indisputable conclusions; and the aggregate of these conclusions, as they gradually accumulate, will form the basis of future theories, each more and more nearly approximating to perfection" (1837, p. 12).

> The disappointment of those who look for a detailed account of geological phenomena in the Bible, rests on a gratuitous expectation of finding therein historical information, respecting all the operations of the Creator in times and places with which the human race has no concern; as reasonably might we object that the Mosaic history is imperfect, because it makes no specific mention of the satellites of Jupiter, or the rings of Saturn, as feel disappointed at not finding in it the history of geological phenomena, the details of which may be fit matter for an encyclopedia of science, but are foreign to the objects of a volume intended only to be a guide of religious belief and moral conduct. (1837, pp. 14-15)

Buckland responded to criticisms from "Mosaic geology" advocates—the forerunners of George McCready Price's tradition (Price 1923; i.e., Whitcomb and Morris 1961):

> Some have attempted to ascribe the formation of all the stratified rocks to the effects of the Mosaic Deluge; an opinion which is irreconcileable with the enormous thickness and almost infinite subdivisions of these strata, and with the numerous and regular successions which they contain of the remains of animals and vegetables, differing more and more widely from existing species, as the strata in which we find them are placed at greater depths. The fact that a large proportion of these remains belong to extinct genera, and almost all of them to extinct species, that lived and multiplied and died on or near the spots where they are now found, shows that the strata in which they occur were deposited slowly and gradually, during long periods of time, and at widely distant intervals. (1837, pp. 16-17)

The same objection applied to anyone still following John Ray's suggestion that the strata may have been deposited between the creation of mankind and the Deluge (Armstrong 1988, p. 154; 1989b, p. 106). Most fossils obviously derived from ages before human beings appeared. Geologic time could be reconciled with Genesis through day-age correlations, which Buckland considered to be allowable exegesis, although he objected that the order of appearance in strata did not match the order in Genesis 1 (1837, pp. 17-18). Therefore, he preferred the "gap theory" of Chalmers (1837, pp. 19-20; cf. 1820, pp. 31-32) "to express an undefined period of time" between the "beginning" and the creative days; "millions of millions of years may have occupied the indefinite interval" (1837, p. 21). All things had been created by the same God. Buckland was not speculating that any demonic creation had existed, as some gap theorists have done.

The Hebrew words *bara* and *asah*, translated "created" and "formed" or "made," might be equivalent or might have different force, but neither one required the assumption that Creation was completely *ex nihilo* (1837, pp. 22-25). If the fossil record belonged to the gap interval, light had presumably existed prior to the evening when creative days began, then had been obscured for a while (1837, pp. 29-31).

Buckland cautioned, at the conclusion of his exegetical excursion:

> After all, it should be recollected that the question is not respecting the correctness of the Mosaic narrative, but of our interpretation of it; and still further, it should be borne in mind that the object of this account was, not to state *in what manner*, but *by whom* the world was made. As the prevailing tendency of men in those early days was to worship the most glorious objects of nature, namely, the sun and moon and stars, it should seem to have been one important point in the Mosaic account of creation, to guard the Israelites against the Polytheism and idolatry of the nations around them; by announcing that

> all these magnificent celestial bodies were no Gods, but the works of One Almighty Creator, to whom alone the worship of mankind is due. (1837, p. 33; original emphasis)

Although he sometimes referred to "multiple" creations, these did not constitute entirely new beginnings but rather incremental "interferences" to refine the order and complexity through countless ages. All were within one plan, "parts of one great system of creation, all bearing marks of derivation from a common author" (1837, p. 61). The fossil record indicated "that the creatures ... were constructed with a view to the varying conditions of the surface of the Earth, and to its gradually increasing capabilities of sustaining more complex forms of organic life, advancing through successive stages of perfection" (1837, p. 107). "Perfection" was used in a relative sense, often synonymous with "complexity," and "nothing can be called imperfect which fully accomplishes the end proposed: thus a Polype, or an Oyster, are as perfectly adapted to their functions at the bottom of the sea, as the wings of the Eagle are perfect, as organs of rapid passage through the air, and the feet of the stag perfect, in regard to their functions of effecting swift locomotion upon the land" (1837, pp. 107-108, note).

Absence of human evidence became one reason for catastrophists' abandonment of correlation with Genesis.

Lower orders "prevailed *chiefly*, at the commencement of organic life, but they did not prevail *exclusively*; we find ... not only remains of radiated and articulated animals and mollusks ... but ... the vertebrata also represented by the Class of Fishes" (1837, p. 115). Reptiles came later, along with footprints—"probably the first traces of Birds and Marsupialia" (1837, p. 115; his illustrations in Volume II actually show dinosaur tracks like those in Texas, including the elongate, plantigrade variety which contributed to the Paluxy "mantrack" allegations). Complex or higher orders "become gradually more abundant, as we advance from the older to the newer series;" but "the more simple orders, though often changed in genus and species ... have pervaded the entire range of fossiliferous formations" (1837, pp. 115-116). "Repeated changes in species ... in succeeding members of different formations, give further evidence, not only of the lapse of time, but also of important changes in the physical condition and climate of the ancient earth" (1837, p. 116). Gradual, progressive changes had been involved, yet not a simple "ladder" of development: squaloid and bony fish continued to co-exist, and there were cases of retrograde development; diversification from a few species and then subtraction, followed by further development and diversification (1837, pp. 293-294). The history of chambered shells among cephalopod mollusks showed "that it is not always by a regular gradation from lower to higher degrees of organization ... many of the more simple forms have maintained their primeval simplicity, through all the varied changes the surface of the earth has undergone; whilst ... organizations of a higher order preceded many of the lower forms of animal life" (1837, p. 312). Such "retrocession" seemed "fatal to the doctrine of *regular progression*, which is most insisted on by those who are unwilling to admit to repeated interferences of the Creative power, in adjusting the successive changes that animal life has undergone" (1837, p. 312, note).

Buckland would not contend that everything was designed for human benefit; our advantage would be "incidental and residual," although "foreseen and comprehended in the plans of the Great Architect of that Globe, which, in his appointed time, was destined to become the scene of human habitation" (1837, p. 99). A footnote tells how little of the universe can be applied to human benefit: "Surely, he must have an overweening conceit of man's importance, who can imagine this stupendous frame of the universe made for him alone" (1837, p. 99, note; cf. Ray 1713, p. 414).

He may have originated the concept of "missing links," in an opposite sense to subsequent usage against evolutionary interpretation. Buckland emphasized that transitional fossils existed, intermediate between living taxa:

> The study of these Remains presents to the Zoologist a large amount of extinct species and genera, bearing important relations to existing forms of animals and vegetables, and often supplying links that had hitherto appeared deficient, in the great chain whereby all animated beings are held together in a series of near and gradual connexions.
>
> This discovery, amid the relics of past creations, of links that seemed wanting in the present system of organic nature, affords to natural Theology an important argument, in proving the unity and universal agency of a common great first cause; since every individual in such an uniform and closely connected series, is thus shown to be an integral part of one grand design.
>
> The non-discovery of such links indeed, would form but a negative and feeble argument against the common origin of organic beings, widely separated from one another; because, for aught we know, the existence of intervals may have formed part of the original design of a

> common creator; and because such apparent voids may perhaps exist only in our own imperfect knowledge; but the presence of such links throughout all past and present modifications of being, shows an unity of design which proves the unity of the intelligence in which it originated. (1837, p. 114)

Remarking upon the subtle gradations between some species, Buckland noted their adaption to different habitats, and the fact that sloths and armadillos are restricted to nearly "the same regions of America that were once the residence of the Megatherium" (1837, p. 144). He cited Richard Owen's study of *Nautilus pompilius* to connect cephalopods, past and present, as apparent relatives (1837, p. 315). Living cycads "form an important link ... connecting the great families of Coniferae, with the families of Palms and Ferns" (1837, p. 502).

Buckland was an empirical scientist as well as a capable theologian. He produced a monograph on coprolites, and gave three dozen specimens of the petrified excrement to the Philpot Museum in Lyme Regis, Dorset (the next town to his childhood home, Axminster, Devon; this author saw the display in 1985). Even coprolites went into his proofs of creation by design: Buckland declared that evidence of intestinal structure from these remains "supplies a new link to that important chain, which connects the lost races ... with species that are actually moving around ourselves. The systematic recurrence ... of the same contrivances, similarly disposed to effect similar purposes, with analogous adaptations to peculiar conditions of existence, shows that they all originated in the same intelligence" (1837, p. 201).

The brilliant eccentric kept a veritable menagerie at his house, together with countless rocks and fossils. Buckland's hyena disturbed the family's dinner guests by crunching one of the guinea pigs (Hallam 1983, p. 62, note 38)! The Bucklands experimented with exotic foods to such an extent that the professor boasted about having eaten his way through much of the animal kingdom. During his honeymoon visit to Palermo, Buckland was shown St. Rosalia's shrine, where he promptly shocked the priests by declaring that the bones were from a goat, not a woman. He also tasted alleged "martyr's blood" on the floor of a European cathedral and said, "I know what it is—bat's urine!" (Hallam 1983, p. 62, note 34).

All foibles aside, Buckland deserves to be read more widely, and remembered for integrating orthodox theology with the latest science. His inspired insights are as relevant today as they were in his time. ✤

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Communications

Science & Christian Faith in Western Europe: A Personal View

Introduction

Various factors have limited American access to European discussion of science and Christian faith. These include the barriers of language and lack of access to non-English speaking communities. As a result, we may be unaware of a recent upsurge of interest in science-Christianity themes. A travel grant offered me the opportunity to spend portions of three summers in Western Europe talking to scientists, theologians, and others about science-theology topics.

Even though Europe and the British Isles are edging toward a common economic community in 1992, there are radically different perspectives among the various peoples which arise from enduring national, ethnic, and religious distinctives. This is reflected in the meanings that are placed on such words as evangelical, theology, religion, and science as well as in the ways that science and Christianity are viewed. For the sake of consistency, I have sought to use these terms in a context understood by a North American reader.

Broad Features

One encouraging note has been three recent landmark conferences which have drawn participants from many parts of Europe and America. The First European Conference on Science and Religion was held in March 1986 at the Evangelische Akademie at Loccum near Hannover in northern West Germany. A spectrum of European scientists, philosophers, and theologians and a few Americans dealt with the familar theme "The Argument about Evolution and Creation." A book, *Creation and Evolution: A European Perspective*, contains a selection of papers which represent the liberal theological views which predominated.[1] The Second European Conference at Enschade, Netherlands (1988) on the theme "One World-Changing Perspectives on Reality" included a contribution by ASA member Hermann Haefner.

In September 1987, The Vatican Secretariat of State sponsored a research Study Week at the Vatican Observatory on the theme, "Our Knowledge of God and Nature: Physics, Philosophy and Theology." Pope John Paul II initiated the conference to stimulate "the dialogue between the culture of religious belief and the scientific culture." Sponsors in addition to the Holy See included the Pontifical Academy of Cracow, The Pontifical Academy of Science, the Pontifical Gregorian University, and the Pontifical Council for Culture. An ecumenical group of 21 participants included Ian Barbour, Mary Hesse, Arthur Peacocke, John Polkinghorne, Frank Tipler, Eran McMullin, Robert Russell, and George Coyne, head of the Vatican Observatory. A full-orbed set of science-religion themes was considered in a free-wheeling fashion that suggested a lack of Papal constraint. Many of the papers stemming from the Study Week are included in *Physics, Philosophy and Theology: A Common Quest for Understanding*, published by Libereria Edutrice Vaticana and the University of Notre Dame Press.[2]

Carl Friedrick von Weisäcker, theoretical physicist and philosopher, has had an enormous influence in promoting discussion of "peace and the environment" in European circles influenced by the World Council of Churches. Co-winner of the 1989 Templeton Prize for Progress in Religion, he has singlehandly driven Europeans of various religious perspectives to serious discussion of these themes.

French and German discussion of the social significance of technology stretches back into the 19th century. Following World War II, the society of German engineers, the Verein Deutscher Ingenieure

(VDI), organized a series of conferences on the philosophy of technology. In 1956, the VDI founded a special "Mensch und Technik" study group which was broken down into working committees on education, religion, language, sociology, and philosophy all in relation to technology. There are indications that this continuing German discussion will become broader as Europe becomes a unified economic community in 1992. French thought on the moral and theological aspects of technology has been strongly influenced by the writings of Henri Bergson in the early 1930s. Jacques Ellul has provided a strong critique of technology more familar to Americans. One significant feature of European reflection on technology is the inclusion of perspectives based on morality and theology which embody a depth and variety not found elsewhere.

Federal Republic of Germany

Until recently, German theology has been dominated by Karl Barth and Rudolph Bultmann, both of whom discouraged dialogue between theology and other disciplines. Karl Heim was a lone dissenting theological voice. His book, *Christian Faith and Natural Science* (1953), influenced an earlier generation of ASA members.[3] On the other hand, German scientists have had a long tradition of interest in science and religion with Werner Heisenberg, Otto Hahn, Günther Howe, Max Planck, and Carl Friedrich von Weizsäcker among the more prominent spokesmen.

Today, the German state-supported "united" Protestant church covers the spectrum of Reformed and Lutheran thought from the very liberal to the conservative pietists. Some conservative groups (often served by American missionaries) form independent congregations. Attendance on Sunday is minimal in the state church, yet there is a strong tradition for diaconal ministry both in Germany and beyond. Traditional pietist concerns for evangelism and a disciplined life, and a separationist mentality, have resulted in little involvement with broader cultural questions, although there are signs of change.

Hermann Haefner (Marburg) has been closely associated with the German Student Mission (SMD). He coordinates various SMD conferences and publications which discuss the relation of Christian faith and social issues including those associated with science. Haefner is also involved with the work of the Karl Heim Society (founded in 1974), an organization which seeks to extend the biblical vision of Karl Heim. A core group of 200 active members develops seminars, lectures, an annual meeting, and publishes the journal *Evangelium und Wissenschaft* which reaches an audience of 800. Hans Schwartz of the theological faculty at the University of Regensberg has provided strategic support for the work of this group.

Not unexpectedly, a group of more conservative members left the Karl Heim Society in 1981 to develop a program of conferences, courses, and the journal *Wort und Wission* with an anti-evolutionary emphasis. The group, led by theologian-scientist Horst W. Beck, continues to keep lines of communication open to their more liberal brothers and sisters; a phenomenon less common in America.

There are many German theologians who are willing to join in dialogue with scientists; a happy contrast to the American state of affairs. One factor may be the pressures which have arisen in the intensive reindustrialization after World War II. Theologians are expected to take leadership in discussions about the environment, technology, and energy and join in the policy-making process. (The nation is serious about the environment and displays a cleanliness most welcome to a traveler by rail.) Some current contributors to the dialogue have degrees in both science and theology, others come to science out of concern for the issues. Some current theologians with strong interests in science include Jürgen Moltmann (ecology), Günther Altner (nuclear energy, biotechnology) and Jürgen Hübner (evolution, biotechnology).

One leading German think-tank, the Protestant Institute for Interdisciplinary Research (FEST) located high on the hill above the ancient part of the University of Heidelberg, focuses on science-theology issues and other interdisciplinary topics. Jürgen Hübner is senior research fellow of the institute and professor of systematic theology at the University of Heidelberg. Hübner and his associates have recently produced a massive annotated bibliography of important German, French, Dutch, and English works on various aspects of the science-faith issues: *Der Dialog zwischen Theologie und Naturwissenschaft: Ein bibliographischer Bereicht.*[4] FEST arose at the end of WWII out of conversations between atomic physicists and theologians concerned with the use of atomic weapons. As issues broadened and changed, new working groups emerged under the FEST umbrella. Recent themes under discussion include the theology of ecology and biotechnology, and the philosophy of nature.

The Institute for Education and Science at Paderborn (Hugo Staudinger) funded by the Roman

Catholic Church has recently published three weighty volumes on science and faith. Both Protestant and Catholic university faculty contributed.

The broadest discussion of science and culture including theology is found in the sixteen German academies. These analogues to Plato's Academy were established after WWII in an attempt to provide a new start for a nation whose cultural base had been seriously eroded by National Socialism. It was felt that cultural renewal had its best chance under the wing of the church, with the result that the academies are funded by the state through the various state churches. Each academy has resident fellows who specialize in broad areas such as sociology, ethics, theology, literature, architecture, lingusitics, science, etc. While visiting the Academy at Loccum, I spent some time with a group of about 75 professionals animatedly discussing psychiatry and the church. This academy had sponsored recent discussions on such science-related topics as AIDS, ethics, genetics, nuclear energy, and the use of animals in research (a German "hot topic"). The academies feel that serious issues are best approached by providing a setting where the concerned parties may meet together in a non-confrontational manner which allows the participants to do their work out of the public eye. The role of the theologian is less that of offering answers than that of raising moral and ethical questions. One recent conference discussed guidelines for genetic research.

I left West Germany impressed with the breadth and depth of interest in science-theology issues and the strong involvement of theologians. Evolutionary topics do not dominate. Philosophical questions related to modern physics receive close attention, and there is strong emphasis on environmental issues and biotechnology. Unfortunately, few participants in science-theology questions are aware of the English language literature. This need is being partly addressed by Hübner's book. Ecumenical discussion is common as Catholics, Protestants, and "Creationists" are more inclined to talk to one another than are their American counterparts.

France

France offers many contrasts with Germany, including a much more "live and let live" attitude toward the environment. Evangelicals are a miniscule minority in a land where the Christian faith has no relevance. Only 4% of France's Catholics are found to attend church regularly. The second largest religion is that of the Muslim immigrants, who make up 4% of the population. Protestants of all stripes have never numbered more than 1.5% since the 16th century, but their influence in many areas has been greater than the percentage would suggest. While evangelicals have grown in number and influence in recent years, a desire for denominational distinctives keeps the small communities of Baptists, Reformed, Free Church, Mennonites, Methodists, etc. from joining in common enterprises.

Protestant theological education takes place in five small seminaries and a scattering of Bible Institutes. Henri Blocher, dean at Faculté Libre de Théologie Evangélique, a seminary located just outside of Paris, has written a well-received work, *In the Beginning: The Opening Chapters of Genesis*.[5] The Faculté Libre and the Faculté Libre de Théologie Réformée in southern France seek to stimulate scholarly intereaction. *Fac-Reflexion* is a new journal which seeks to examine theological and cultural issues. The April 1988 issue offers an article, "La Médecine Est En Marche: Avec Ou Sans Nous?" by Robert Somerville, professor of ethics, lecturer, and member of the Ethics Commission of the Protestant Federation of France; and an article, "En Perspective: L'Analogie de la Creation," by Henri Blocher. The November 1988 issue of *La Revue Réformée* offered various responses to Carl F. von Weizsäcker's call for discussion of peace and the preservation of creation.

There are evangelicals with scientific interests in various universities, and a theologian at Strasbourg interested in ecological issues. I found a desire among faculty to broaden the discussion on science-faith issues in spite of the pressures on faculty time in struggling seminaries. Many in the church have a new awareness of responsibilities in the world, but the community has few resources to meet the challenge. Evolution/creation topics are prominent in part due to a small but active creationist movement.

The Netherlands

The peoples who live behind the dikes have produced more than their share of scientists, mathematicians, philosophers, and theologians. Long cherishing freedom of thought, the Dutch have often embraced those whose ideas have not been welcomed in their own homeland. The ASA and CSCA have many members who find their roots in this small nation whose population density is twelve times that of the USA.

Although secularism and confessional liberalism

have distorted the Calvinistic outlook that we associate with Dutch society, the traditions embodied in Abraham Kuyper, founding father of the Free University, continue in modern dress. Prominent recent exponents of Calvinistic theology and world view thinking include Herman Dooyeweerd and Dirk H. Th. Vollenhoven. The Association for Calvinist Theology (1935) was a scholarly outcome of these men and their students. The Association numbers about 450 members today with about 100 residing outside of the Netherlands. It sponsors conferences, seminars, the bimonthly *Beweging*, and *Philosophia Reformata*, an international scholarly quarterly. Spin-offs from this group support chairs in "Calvinistic Philosophy" at Dutch universities. The Centre for Reformational Philosophy led by Frank Dykstra at Utrecht administers the work of the Association and organizes lectures and conferences. The Centre is more philosophical, specifically Calvinistic, and has less active involvement in day-to-day issues. In 1986, they sponsored an international conference on anthropology and Christianity (in English) at Zeist.

The Institute for Christian Studies is a broader group (about 17 denominations involved) of several hundred members, which has emerged in recent years out of a desire to serve a broader evangelical and Catholic constituency seeking to work out the implication of faith for their professions. Most of the science-related discussion takes place in specialized study groups sponsored by the Institute. Recent concerns have included environmental questions, artificial intelligence, and evolution. The idea of the working group is to attack a particular issue over a period of time with a view to publishing the results, in contrast with the more common "lone-ranger" approach. Some Christian faculty have had influence on governmental commissions related to genetic research and environmental questions. One physicist-philosopher-historian of science in the Dooyeweerd mold, M.D. Stafleu, has written a valuable study of the Copernican period, *Theories at Work: On the Structure and Functioning of Theories in Science*.[6]

A new institution, Evangel College, seeking to become an international Christian university, holds a creationist position. Evangel is struggling to survive in an environment which expects the state to pay for higher education. Evangel offers an option for Christian students to gain a Christian foundation before entering the state universities.

There is a tension among exponents of the Dooyeweerdian tradition who feel that too much current Christian thinking in ethics and other issues is superficial and amateur, yet participants of the Institute for Christian Studies feel that they cannot wait for the results of the ponderous and complex discussions of the Association. The compromise has been to do a little of both.

Spain

The recent radical political changes in Spain have provided unprecedented religious freedom. Churches may now own property, but prejudice and fear continue to hamper the work of Protestants. The number of evangelicals is estimated at 70,000—a minor fraction in relation to a total population of 38 million. A decline in the significance of the Catholic church in public life has opened a new window for evangelism which is tempered by a growing secularism and an indifference among the younger community to their personal and collective futures.

Valencia University mathematician Enrique Vidal and Barcelona University biochemist David Andreu spearhead the work of a few scattered evangelicals who are seeking to publish Spanish language works in theology and the relation of Christianity to various areas of life. They have begun a quarterly popular magazine and wish to publish a work dealing with science-faith issues from a Spanish perspective. The limited market for such publications is a large barrier.

Coordinadora Creacionista is a small group of evangelical Christians in different specialities including teachers, biologists, physicists, chemists, and a few medical doctors. They present lectures and seminars and are planning the Third Barcelona Creationist Seminar for October 1989.

Italy

Italy has few Protestants and far fewer evangelicals. Evangelism faces resistance from traditional Catholics and from Communists, as well as an indifference on the part of the general public to any and all religions. Analytical chemist Roberto Frache, of the University of Genoa, works with a handful of Christian students who come to the university from Protestant churches. He is concerned that primary materials on science-Christianity questions come from translated Creation Research Society publications. Recently, Henri Blocher's *In the Beginning* has appeared in Italian. There is a need for materials written from an Italian perspective.

Catholic scholars have long included nature in

the development of their theology, but this has not been without conflict. The Paris condemnations of "errors" in theology and natural philosophy in 1277, and that of Gallileo (1633), had a profound influence on the course of science in lands dominated by Catholic thought. Official Catholicism after Galileo withdrew from any direct connection with the world of science by stating their positions on creation and natural theology from tradition rather than the contemporary scientific world view. In the 19th century, Catholics were on the defensive in many lands and sought to stay out of the public debates that Protestants enjoyed. Catholics kept their argument in the family. At most, evolution was tolerated in principle as having no bearing on Catholic faith as long as the origin of man was not raised. One Catholic, biologist George Mivart, crossed ecclesiastical lines only to have his articles placed on the Index of the Holy Office. As late as the 1950s, evolution was still considered a "hypothesis." 1955 was a watershed year, with the death of Teilhard de Chardin who during his lifetime had not been allowed to publish his works on theology and evolution. Succeeding years saw the gradual release of his work, and the flood of responses testifies to the profound influence that he had on Catholic and non-Catholic thought. The 1987 Study Week at the Papal Palace represents a momumental change in "official" attitudes, and a clear signal for Catholic thinkers to contribute to the dialogue.

Greece

There are an estimated 7-10,000 evangelicals in this nation of 10 million. 97 percent of the people belong to the state Greek Orthodox Church. One challenging work is led by an American-educated Greek who has founded a "good news" movement, reaching 500 members of the Orthodox Church. The American-run Greek Bible Institute seeks to educate lay leaders and pastors. There is an interest in science-faith issues, but nothing in the Greek language to address the subject and little incentive to produce materials for such a limited market.

The United Kingdom

The study of the role of Christianity in the development of English science and technology has produced voluminous and occasionally controversial literature. Evangelical chemist-historian of science Colin Russell's *Cross-Currents: Interactions Between Science and Faith* is a recent look at the British scene since Newton.[7]

English Christianity since the Reformation has been a complex and changing matrix of state-church Anglican orthodoxy and heterodoxy mixed with dissenting sects of bewildering variety. Today one finds differing perspectives and some resentment on crossing borders between England, Wales, Ireland, and Scotland. It may be surprising to note that this once "Protestant" nation now is over 50 percent Roman Catholic.

There has been a steady evangelical growth in the Anglican church since WWII, measured both in numbers and scholarship. There are six evangelical theological institutions associated with various English universities and counterparts in Scotland and Wales. At the same time, there has been an increasing drive for evangelicals to address concerns beyond evangelism and missionary work. Oliver Barclay's *Whatever Happened to the Jesus Lane Lot* recounts the struggles of student Christian groups at the universities over the last century.[8]

There are winds of change in the organizational structures of two venerable English evangelical organizations. The Victoria Institute was founded in 1865 to combat "scientific coteries" and "defend the great truths of scripture." The organization was mostly made up of people in the professions and business, sprinkled with politicians and a few scientists of dubious reputation. Though anti-evolution at first, the organization had joined the theistic evolution camp by the 1920s. Because its library and study center were destroyed by bombs in WWII, the institute has had little recent influence on the British scene other than through its journal *Faith and Thought*, which published the 114th (and last) volume in 1988. Much more intense discussion of science/Christianity topics has taken place in recent years in the Research Scientists Christian Fellowship (RSCF), the organization which cosponsored with ASA/CSCA the Annual Meeting at St. Catherine's College, Oxford in 1985. RSCF has never had a formal journal and recently has joined with the Victoria Institute to cosponsor a new journal, *Science and Christian Belief*, which began publication in 1989 with Oliver Barclay and A. Brian Robins as coeditors. RSCF has made it a clean sweep by a name change to Christians in Science.

Recent writers on science and Christian faith include Thomas Torrance, John Polkinghorne, David Livingston, Douglas Spanner, R.J. and Caroline Berry, Arthur Peacocke, and Iain Paul. Medical ethics is a topic of intense discussion. Oxford is the home for the Ian Ramsey Centre, which sponsors seminars, lectures, and working groups dealing with ethical issues related to medicine and -

environmental concerns. Another recent event is the establishment of the Whitefield Institute under the direction of David Cook, a fellow in medical ethics at Green College, Oxford. The Institute seeks to develop the next generation of English evangelical scholars and leaders in the areas of theology, philosophy, ethics, and education by funding graduate work in these areas which often touch on science issues.

The Science and Religion Forum is a loosely bound group of about 150 theologians, pastors, and scientists who meet annually to discuss various themes. A less traditional Oxford organization is the Alister Hardy Research Centre which supports research on "religious or transcendent experiences" in Christian and non-Christian contexts. These "scientific" psychological/sociological studies seek to identify various dimensions of "transcendent experiences" with a view to countering what is seen as the world view of the European Enlightenment which tended to dismiss non-material reality.

Conclusions

This necessarily selective survey suggests that there is a wide and diverse interest in science-Christianity themes in both the English and non-English speaking nations of Europe. The discussion embraces topics similar to those in North America, but with a flavor which reflects local concerns. In a few instances the voice of the Church and individual Christians is heard at national levels of decision making. Evangelicals play a part in these discussions, and continue to develop ways to educate their constituency and develop an apologetic to reach the unchurched. The ASA should seek to develop stronger links with our European counterparts. This may include one-to-one contact on visits to Europe, participation in meetings, exchange of literature and reports of meetings, and paper summaries in *Perspectives* and the ASA *Newsletter*. There may be opportunities for short-term teaching (with a translator) and to help in writing projects. We, in turn, can benefit from these associations which offer new perspectives as we seek to hone our understanding of ourselves and nature in the light of Christian faith. ✤

ACKNOWLEDGEMENTS

I want to thank the many people who were willing to offer hospitality and discuss hard questions with a wandering American carrying a tape recorder. I wish also to thank the Pew Foundation for a travel grant which made this project possible.

NOTES

[1]Svend Anderson and Arthur Peacocke (eds.), *Creation and Evolution: A European Perspective* (Aarhus, Denmark: Aarhus University Press, 1987).

[2]Robert John Russell, William R. Stoeger, and George V. Coyne (eds.), *Physics, Philosophy and Theology: A Common Quest for Understanding* (South Bend, IN: University of Notre Dame Press, 1988).

[3]Karl Heim, *Christian Faith and Modern Science: The Creative Encounter Between 20th Century Physics and Christian Existentialism*, translated by N. Horton Smith (New York: Harper and Row, 1953).

[4]Jürgen Hübner, *Der Dialog zwischen Theolgie and Naturwissenschauft: Ein bibliofraphischer Bericht* (Munchen: Christian Kaiser, 1987).

[5]Henri Blocher, *In the Beginning: The Opening Chapters of Genesis*, translated by David G. Pearson (Downers Grove, IL: InterVarsity Press, 1984). French edition reviewed in the *ASA Journal* March 1985, pp. 59-60; English edition, December 1985, pp. 239-40.

[6]Marinus Dirk Stafleu, *Theories at Work: On the Structure and Functioning of Theories in Science in Particular During the Copernican Revolution* (Lanham MD: University Press of America, 1987).

[7]Colin A. Russell, *Cross-Currents: Interactions Between Science & Faith* (Grand Rapids: Eerdmans, 1985).

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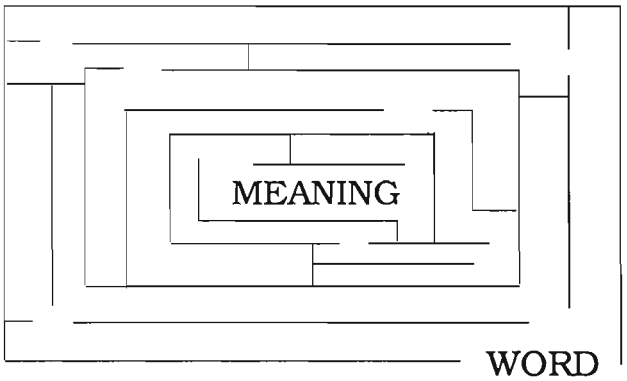
Penetrating the Word Maze



Taking a look at words we often use—and misuse. Please let us know whether these attempts at clarification are helpful to you.

Today's words are: "soul/spirit."

The Dictionary definitions: *Soul: "The immaterial essence, animating principle, or actuating cause of an individual life; the quality that arouses emotion or sentiment."* ***Spirit:*** *"an animating or vital principle held to give life to physical organisms; the immaterial intelligent or sentient part of a person."* [Webster's Ninth New Collegiate Dictionary, Merriam-Webster, Springfield, MA (1987)].

* * * * *

In two previous Word Mazes we've taken a look at "life/death" and "human/personal." An understanding of "soul/spirit" closes the links between these three interrelated cases.

Few widely used terms are clouded by as much ambiguity, uncertainty, and plain ignorance as are the terms "soul" and "spirit." They are frequently talked about. They appear constantly in sermons and articles. But seldom do we really come to grips with the basic question, "Just what do these words mean?"—not as connotative symbols of non-verbalizable feelings, but as actual terms whose meaning can presumably be defined and delineated.

Opinions cover a wide range. Of course there are those who say that these words don't mean anything, that they are only symbols for subjective impressions. The body is the only real, objective entity.

One strand of traditional Christian thought, on the other extreme, joins with Greek thought and commits itself to a dichotomous (or trichotomous) position: each person has two (or three) entities, a body and a soul (and a spirit). The soul is the divine part of the human being, and the body is the earthly part.

The dictionary definitions given above demonstrate immediately how difficult it is to distinguish between the meanings of "soul" and "spirit" in popular usage, and this difficulty is confirmed by the essentially indistinguishable usage that St. Paul sometimes makes of the two terms in his New Testament writings.

An investigation of the biblical use of these terms and their Old Testament counterparts can, however, be very helpful. It becomes clear that the Bible uses "soul" (Old Testament: *nephesh*; New Testament: *psuche*) when it speaks of the personal self of a being, with all the attributes that accompany a personal self such as self-consciousness and the ability to think and feel. In the Old Testament, *nephesh* is applied to the properties of non-human animals as well as to human persons. The biblical concept of "spirit" (Old Testament: *ruach*; New Testament: *pneuma*) is often not clearly distinguished from that of "soul," but there is a tendency to use this word to describe the ability of a human person to be in a personal relationship with God, to make responsible moral choices, and in general to be able to interact with the Spirit of God.

This column is a regular feature of *Perspectives on Science and Christian Faith*, and is written by Richard H. Bube, Professor of Materials Science and Electrical Engineering at Stanford University, Stanford, California.

In thinking about the meaning of "life," we saw that confusion was removed if we realized that life is not a noun, something we *have*, but that rather being alive (an adjective) is something that we *are*. Exactly the same kind of removal of confusion is achieved if we recognize that a "soul" or a "spirit" is not an immaterial entity that we *have*, but rather that "being soulful" or "being spiritual" are descriptive expressions describing the kind of creature that a human person *is*.

A number of significant conclusions follow directly from such an approach:

A human person does not consist of a body to which a soul and a spirit have been added. A human person exhibits a variety of properties commensurate with personal identity: bodily characteristics, soulful characteristics, and spiritual characteristics.

Becoming soulful and spiritual are processes that take place over periods of time, not instantaneous events associated with the addition or subtraction of independent entities called souls or spirits. At a given stage of development, the bodily structure and material interactions of a creature (what we have called the biological realm) form the foundation for the ability of the creature to manifest soulful or spiritual characteristics.

No stage in the conception-to-birth-and-beyond process corresponds to the infusion of a soul, nor does any stage in the dying process correspond to the removal of a soul. Both the developing process at the beginning of life and the dying process at the end of life are characterized by more or less continuous increases or decreases in soulfulness, respectively. Such changes are commensurate with the extent of personal life manifested as a function of time.

We should look at the human person as a whole: a biological system created by God and given dynamic existence in such a way that from the given structure and pattern of interactions those properties emerge that we recognize as being soulful or spiritual.

There is a hierarchical relationship between these properties. Spiritual properties cannot be manifested unless soulful properties can be manifested. There are neither spiritual nor soulful properties if there are not the appropriate bodily (biological) processes.

Recognition of these relationships means that a number of problems usually thought to be serious are not problems at all; rather they are cases of "asking the wrong questions":

"When does the soul enter the body of the unborn?"—with all of its implications for abortion and medical ethics. The right question is, "Over what time period and in what order does the unborn acquire the ability to manifest a variety of soulful properties?"

"If evolution were right, when was the human soul created?"—with all of its implications for the creation/evolution debate. The right question is, "If evolution were right, over what time period and in what order did the biological structure and interactions necessary for manifesting soulful properties come into existence?"

"Can we have evidence for the creation of human beings in the image of God if we cannot demonstrate that the soul (and the spirit) has existence independent of the body?"—with all of its implications for a theological understanding of the nature of the human being. The right question is, "How does God's creative activity enable human beings to manifest soulful and spiritual characteristics?"

"Isn't it more important to save a person's soul than his body?"—with all its implications for Christian witness and service. The right question is, "How can we best minister to the whole person, helping bodily, soulful, and spiritual potentialities to become realities?"

We will never understand the nature and significance of the human person if we attempt to force upon him the mechanical mold of separate entities being joined together in some way during life, and being separated again at death. God has created us in a certain way to live in this world; in the resurrection He will initiate His new creation in a way that maintains our personal identity and that is suitable for the new life that is presently beyond our comprehension.

Should we continue to talk about body, soul, and spirit—or should we just be careful to avoid all confusion by emphasizing that a human person is a pneumopsychosomatic unity? ✤

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Reflections on S.W. Hawking's *A Brief History of Time*

A BRIEF HISTORY OF TIME by S.W. Hawking. New York: Bantam Books, 1988. 198 pages. Hardcover; $18.95.

It is commonly assumed in Christian circles that the conflict between science and faith has been more or less settled as far as physical science is concerned. It is thought that there still seems to be some conflict between the life sciences and faith, and clearly the social sciences remain intensely hostile to Christianity, but apparently physical science has reached a relatively easy accommodation with Christian belief. The more mathematical a scientific discipline becomes, the less does there seem to be an intersection between it and the Christian view of the world. Where there is no intersection there can be no conflict. Indeed, the mathematical structures of physics may even yield useful analogies for the Christian apologist.

Stephen Hawking's book is likely to cause these assumptions to be questioned. Although he is a professor of mathematics, he has deliberately written a non-mathematical book. Humourously, in the preface he writes that because equations would depress the sales of the book he has included only one, namely Einstein's famous equivalence of energy and mass. He hopes that this one equation will not halve the number of potential readers! Since the book is a best-seller even in a hardcover edition, there was no need to fear loss of sales. In any case, even Einstein's equation is not so much a piece of mathematics as a statement about physical phenomena, and the work is about such phenomena rather than about the logical connections between them. But the absence of mathematics is insufficient to account for the popularity of the work. Nor can that popularity be attributed entirely to the astounding lucidity with which complicated processes are made accessible to ordinary people. Even the altogether delightful sense of humour is insufficient to cause the man in the street to read such a profoundly serious book. The reason for Hawking's success as a writer is that he addresses the problems of meaning and purpose which bother all human beings, if not every day then every other day. Hawking has written a religious book in a scientific setting. It is a work which is more religious than many a church service, and it is explicit in its frequent use of the word God. The author speaks to modern readers who look for religious convictions, but who also look for them to carry the imprimatur of science.

Naturally, then, this book intersects with Christian belief and does so deliberately, but graciously and without rancour. It is an important book and needs to be treated by Christians with great respect and attention, although of course there is no need to agree with everything the author says.

The book starts with Aristotle's view of the universe and Ptolemy's development of it. The stationary earth is at the centre of the universe and the heavenly bodies attached to spheres rotate around it. This universe is finite because there is nothing to be observed beyond the outermost sphere which carries the fixed stars. This Aristotelian model was accepted by the Christian church as being in accordance with Scripture. Hawking surmises that the chief reason for this acceptance was that the model left plenty of space for the location of heaven and hell. Since he immediately replaces the Aristotelian model with the Copernican one of a stationary sun, there is here a gentle poking of fun at heaven and hell as well as their location in space. More seriously, the opposition of the church to the Copernican model is connected with its scientifically erroneous view of a central earth. Aristotle is rebuked for his mystical belief in circular motion and Christians for the use of Scripture, spelled respectfully with a capital "S." Alongside these subjective notions, Hawking places the objectivity of Galileo's observations of the night sky and couples this with a side-swipe of the absurd notion of pretending that the difference between Ptolemy and Copernicus is merely arbitrary. In a few pages the scene has been set for conflict between scientific knowledge and nonscientific make-believe.

This does not mean that scientific thinkers get good marks throughout. Newton, for example, not only has a bad character reference in an appendix to the book, but is also shown to be in error about the possibility of a static universe of infinite extent. This leads to the first examination of the beginning of the universe and a mention of its expansion,

which would seem to require an instant of creation. In this context there are frequent references to God, but in a very detached way. The first chapter concludes with a brilliant summary of the scientific method as seen by the author. In summary, he states that science is concerned with the construction of models, which are useful in making predictions. The eventual goal is to provide a single model to describe the whole universe. Although the models exist only in our minds, a universal model could be used to predict our thoughts and actions. Hawking regards this as a paradox, which cannot be resolved except perhaps by reference to Darwin's principle of natural selection, which favours correct theories.

The second chapter starts with Galileo's and Newton's clarification of the laws of motion. Hawking is particularly concerned with the absence of a unique standard of rest and therefore of position, and this leads him immediately to the impossibility of absolute time and the necessity of Einstein's postulate of relativity, in which the laws of science are the same for all freely moving observers. The exposition of both restricted and general relativity is concise and breathtaking in its mastery of the subject. The central feature of the universe is shown to be space-time interacting with matter. Hawking refers to his own early work, which led him to the conclusion that the general theory of relativity implies that the universe must have a beginning and perhaps an end in time.

Next, the book deals at some length with the expansion of the universe. Here the reader is confronted with the immense number of the heavenly bodies and the inconceivable distances between them. Not only is the earth no longer at the centre of the model, but the sun itself has no special position or size. The reader is unlikely to miss the implicit conclusion that mankind has little claim to being special or important. Yet, curiously, the ideas underlying the model are shown to be important, and throughout the book Hawking takes a roll-call of Nobel prizewinners who have contributed to the development of cosmology. There are even consolation prizes for people who failed to obtain the Nobel mark of approval. After a brief look at possible steady-state models of continuous creation, we are left in no doubt that the observed expansion together with other observations of radio astronomy lead inevitably to the conclusion that there must have been a Big-Bang singularity at the outset, unless the structure of that singularity were to be affected by the small-scale effects of quantum mechanics. The clue, that a combination of very large-scale with very small-scale effects may unravel the secret, is reminiscent of the very best kind of detective story.

But before he follows the clue the author has to resolve a number of philosophical and experimental problems. First amongst these is the question of how far scientific principles can be used to predict what happens in the universe. The doctrine of complete predictability has always been resisted by religious thinkers who felt that it infringed God's freedom to act. It has also been resisted by many scientific thinkers, but has been accepted by popular science as inevitable. Indeed, in popular writings a scientific description is almost identical with a deterministic one. Hawking describes how this identity was shown to be false with the discovery of the fact that energy is transferred in packets called quanta. This experimental fact led to the formulation of the Uncertainty Principle, which draws attention to the impossibility of knowing both the position and velocity of particles of matter. Philosophically, this points strongly to the result that all predictions of mechanical events are subject to uncertainty. Scientifically, particles are seen to have wave-like properties, and this means that the "singularity" of a particle is completely modified.

There follows a chapter dealing with the present state of the theory of elementary particles. Very skillfully, Professor Hawking hints that the apparent complications of the existence of many kinds of particles can be resolved by pointing to an underlying unity in terms of energy, force, and symmetry. Another important clue is inserted into the discussion by drawing attention to the fact that the laws of physics are not identical when the direction of time is reversed.

Since the book is primarily concerned with the origin (and end) of the universe, the author seeks to elucidate what happens at a singularity, such as the "Big-Bang" of creation. This makes him turn to existing partial singularities in the universe, which are known as black holes. The two chapters dealing with such regions of space are enormously exciting both intellectually and emotionally. Hawking is writing about his own discoveries, and his account must be read in his own words. A summary cannot attempt to recapture the mystery of regions of space which suck into themselves any matter or energy in their vicinity, and which allow these objects to send no signals of their fate when they are swallowed up. Hawking's scientific account is illuminated by colloquial expressions like: "to detect a black hole might seem like looking for a black cat in a coal cellar;" "a black hole has no hair;" and,

"God abhors a naked singularity." The last statement provides another clue to Hawking's argument. Even black holes have some connection with the rest of the universe. They should slowly evaporate, because quantum mechanics should remove the singularities predicted by the general relativity theory.

The scene is now set for discussing the Big Bang singularity of the beginning of the universe and the Big Crunch singularity of its end. Black holes have been shown to have a less singular structure than might have been imagined. Could it be that something can be discovered from them about the beginning and end of the universe? Here the author has a dig at the Catholic Church, and claims that at a conference at the Vatican at which he gave a lecture, the Pope had warned the conference members to limit their investigations to events after the Big Bang so as to not intrude into the creative work of God. He expresses his relief that the Pope had not heard his lecture, because he did not wish to share the fate of Galileo!

There are four questions which Hawking wants to investigate. Why was the early universe so hot? Why is it now so uniform? Why did it start at the rate of expansion which we now observe? Why are there local irregularities like stars and galaxies? In the discussion of these questions there are repeated mentions of God. How did God choose the boundary conditions which set the universe on its present path? Are they incomprehensibly chosen and does the system afterwards continue by comprehensible laws? It could of course be that there are infinitely many universes, but that we observe only the one in which we live. The initial conditions for different universes could be different, so that the question of choosing particular conditions would not arise, but such possibilities do not fit easily into a framework of scientific law.

Here the author introduces the Anthropic Principle, which introduces the human observer as an essential constituent. The principle can be stated as: "We see the universe the way it is because we exist." This principle can be stated in either a strong or a weak form. The strong version is that our universe is such as to make human life possible. This comes close to the religious statement of a divine purpose in creation. Hawking dismisses the strong form of the Anthropic Principle, because it places the inhabitants of our small planet at the centre of importance and reverts to something like Ptolemy's geocentric cosmology. He is happier with a weak form, that the necessary conditions for intelligent life will be met only in certain regions of time and space. We should not be surprised to find that the conditions in our region are right for our existence.

However, such a bland statement does not by itself give a scientific explanation for the underlying order of the universe. So the author resumes the quest for an understanding of the Big Bang singularity. The book is close to its climax. Since even black holes are not as black as was first thought, Hawking now suggests that the Big Bang singularity may not after all be such as to cause the laws of physics to break down. In that case, there would be no need for boundary conditions at the instant of creation, or indeed at any instant.

The discussion is necessarily technical and mathematical. It involves the suggestion that quantum theory can be formulated by taking into account every possible path a particle might take in space-time. Coupled with this suggestion (due to Feynman), there is the proposal that the time coordinate should be modified in the equations in a manner which is familiar to electrical engineers, who prefer to work in the "frequency domain" rather than in "real time." These suggestions, together with Einstein's idea of curved space-time, lead to the possibility that space-time can be finite in extent but have no boundary or edge. The universe would then be completely self-contained and not affected by anything outside itself. It would have neither beginning nor end, nor, in Hawking's view, any need of a Creator.

But how can this be made to fit together with the observations which show that time has direction? The author tackles this question in a fascinating chapter on "The Arrow of Time." He reverts to the absence of symmetry when time is reversed. A film run backwards shows life very differently. In real life, a cup falling off a table breaks into pieces. When time is reversed, the pieces gather themselves off the floor and form an unbroken cup on the table.

In his view there are three arrows of time: the thermodynamic arrow, the psychological arrow, and the cosmological arrow. The thermodynamic arrow draws attention to the fact that there are many more disordered states than ordered ones, so that the probability is that disorder in a system will increase. The psychological direction of time is linked to the thermodynamic one by the structure of the brain, so that we remember things in the direction of increasing disorder. Lastly, the cosmological arrow of time, which is in the direction of an expanding universe, will reverse when the

universe begins to contract, but at that time intelligent life will not be possible because of the high degree of disorder.

The final chapter is titled "The Unification of Physics." It contains a section on string theories in which the fundamental particles of physics are replaced by even more fundamental geometrical objects called strings. Here the author is leading his readers into the most recent thoughts of cosmologists and into unfamiliar territory. Nevertheless, the explanations reinforced by simple diagrams are extremely lucid. The purpose of string theories is to incorporate the Uncertainty Principle into General Relativity, and by this means to achieve a unified theory dealing with all of physics. Hawking is hopeful that such unification is both possible and not far away. He faces the question that there might be no such theory and that ultimately events occur in a random and arbitrary manner. It is interesting that he thinks that such a view appeals to some who want to defend the sovereignty of God, but he cites St. Augustine to show that no such defence is necessary. He also dismisses the possibility of an infinite succession of ever more accurate theories. Instead, he puts his faith in a single unified theory which is almost within our grasp. Such a theory would not of itself allow us to predict the behaviour of complicated systems, but it would be an important step to our understanding of the events around us and of our own existence.

A short conclusion summarises the arguments of the book. The search is for an understanding of the world around us and of ourselves. In early times, men thought that phenomena were governed by spirits who acted in an unpredictable manner. Gradually the orderliness of nature was observed and the underlying laws of science were discovered. The role of God was then confined to the act of creation. Now this role is in question because it is likely that the laws of physics apply even at the moment of creation. God had no freedom to choose the initial conditions which set the universe going. We are now close to the possibility of answering the question as to why the universe is the way it is. When we can do so, we shall "know the mind of God."

In spite of the apparent dismissal of God from activity in a universe completely described by scientific laws, the last words of Hawking's conclusion affirm a belief in God. Indeed, this is a religious book throughout, and it is important to discover what this religion is like. From a Christian point of view, one needs to know what the similarities and differences are between Christianity and the religious view of the book. Can Christians learn something from Hawking as a religious writer as well as from his brilliant powers of scientific explanation? Is there necessarily a conflict between the two religious views, or can they be reconciled with each other?

Let us first examine the strength of Hawking's point of view. Foremost among these is his commitment to rationality. We live in a time when reason is at a discount. The message of contemporary art and music is that life is essentially chaotic, and Christians as children of their age also stress the irrational in their faith and experience. Scientists and mathematicians, whose work depends on reason, often seem to lack the conviction that the domain of reason extends beyond their professional activities. Hawking will have none of this. He derides philosophers who, like Wittgenstein, reduce philosophy to the analysis of language. His philosophy is about the nature of the universe, and that includes everything. Nor does he admit that there are cracks and fissures in which unreason can hide. Unlike some Christian apologists, he does not insert God into the Uncertainty Principle. Rather, he pokes fun at the idea that God should seek to achieve his purposes through physical events described by uncertainty. The Uncertainty Principle is itself a part of rationality.

This spirited defence of reason is altogether admirable. Moreover, it also has a strong appeal to the man in the street. The brokenness of modern thought often contains a cry for help. Nonsense is not an option for normal human beings, and Hawking writes explicitly for ordinary people who can share the assurance that the world is reasonable.

The second strong feature of the religious view of the book is faith. Several times in the argument the question of the existence of scientific laws is posed, and every time it is answered by total faith in rationality. A layman can only guess at the intellectual effort involved in the search for the fundamental laws, for which there is no guaranteed success. Often there must be disappointment and always the work is incredibly demanding. Always the results have to be tested against observation and have to be adjusted to fit into each other. Faith has to be prepared to accept failure when a bright idea is shown to lead to a dead end. In the popular view, faith is contrasted with reason. Hawking shows faith cooperating with reason. One can even infer from the book that reason by itself is insufficient, because it has to be buttressed by faith.

All this is very positive, but there are also some remarkable weaknesses in this religion. A curiously weak section is the one which deals with the "arrow of time." The Second Law of Thermodynamics is unassailable, but the link between it and the psychological direction of time is unconvincing. It is common experience that a cup falls and breaks. It is also common experience that unbroken cups are for sale in the shops to replace the ones we have broken. It is curious to read that our memories act in accordance with increasing disorder. This is contrary to experience, and if it were to be correct, it is doubtful there would be a University of Cambridge and a Lucasian professorship for the author. The whole thrust of science and of the author's work is towards increasing order. Our lives between birth and death show both increasing order and increasing disorder, but the meaning is chiefly in the order. It is the human predicament that the Second Law of Thermodynamics prevails in death, but that is not the whole story or the more important part of the story. Similarly, the argument about the cosmological arrow of time does not carry conviction. The Anthropic Principle has a strangely unscientific flavour. Its weakness seems to lie in the fact that it is not a scientific law but a statement about the human observer. This brings us to the central difficulty of Hawking's religious as against his scientific views. How are human beings to be incorporated into the unified theory of physics?

In the first chapter, there is a very interesting discussion about the nature of scientific theory which has already been mentioned. Hawking states categorically that a theory is "just a model of the universe or a restricted part of it and a set of rules that relate quantities in the model to observations that we make. It exists only in our minds and does not have any other reality." The rest of the book and the triumphant final statement about knowing the mind of God suggest on the other hand that the unified theory which is its quest is "the" theory rather than "a" theory, and that its reality is rather more solid than the disclaimer at the beginning of the book implies. The author's many references to the progress of science sound a confident note. The model of the universe is speedily replaced by the actual universe itself. We need to enquire why he uses the word "model" and how far such a model can be coextensive with the object modelled. It is not obvious what is meant by "quantities in the model" or how such quantities are related to observations, which in the nature of things cannot be made on the model. It is also important to find out how such models are constructed.

Our enquiry can best start with an examination of Hawking's model of the universe. If we change the metaphor and regard the model and its activity as a play, we can ask for a list of the dramatis personae in this play.

The lead role is taken by a character called "space-time." This is a geometrical object which has the property of curvature. There is a married couple called energy and matter. Amongst the attendants of energy, there are gravity and force. Matter is attended by particles and strings. There is a space traveller, whose task is to send signals from the vicinity of black holes but who has no human features. The action of the play is moved forward by the comments of a chorus of a human scientists, many of whom are Nobel prizewinners.

Clearly the play, or model, has extremely few actors. None of the principle actors are recognisably human. The Anthropic Principle, which has been mentioned before, supplies stage lighting, but does not add human interest. The chorus however does consist of recognisable human beings, who take pleasure in being awarded the Nobel prize and are sad when this honour passes them by. The leader of the chorus is the author himself, and he is intensely human. So far I have made no reference to his illness, because it was irrelevant to a discussion of his scientific and religious views and it would have been impertinent to mention it. But in a discussion of the human element of the book, Hawking's amazing courage in the face of his disabilities must be included. It seems to me that the fallacy of equating the model of the universe with the universe itself is totally exposed by noting that this book was written by a man in a wheelchair, a married man with a family, a professor with colleagues and students, a man the very opposite of an unfeeling robotic look-a-like. It follows that however grand the unified theory of physics is in its grasp of inconceivable distances both small and great, and in its incorporation of the beginning and the end of time, it is not grand enough to incorporate human beings, and its God is not sufficient to answer the urgent questions arising from human experience. This is no appeal to an Anthropic Principle, but a direct appeal to observation of the world as it is and not of a model of that world.

A hint that Hawking himself has doubts about the completeness of his model arises in his discussion of what remains to be done in science once physics has been unified. He suggests that once the theory is complete it only remains to devise better means of calculation and of approximation. These might then lead to the prediction of human

behaviour from mathematical equations, which so far has not been possible.

An alternative view of his complete model is that its very completeness shows its limitations. The glory of its completeness is bought at the price of excluding much of experience. The scientific method necessarily and rightly works by the reduction and separation of the variables. It is not surprising that a theory dealing with space-time gives results about space-time. That is why Hawking's proposal of unbounded space-time is so reasonable. It would surely be surprising if such a model could point to anything outside itself. A weakness of Christian apologetics has often been to try to insert God into a model instead of seeing him in the world itself. Hawking's God is also very much restricted to the model of physics. He seems to have no other characteristics than those from which the model is constructed.

In stressing the importance of human characteristics for a full understanding of the universe we might be accused of attaching undue importance to the inhabitants of an insignificant planet attached to an average star in an ordinary galaxy. But we cannot escape from having to make sense of our existence, and our existence is necessarily to do with our observations. Hawking's religion has the appearance of a proper humility in this respect, but it denies that humility by drawing attention to the marvels of a scientific theory which is said to exist only in the minds of human beings. One has to conclude that the God to whom he refers is similarly a human construct, and such an idea is as far from humility as is possible.

It therefore seems that the religion of this book cannot be reconciled with Christianity, in spite of its many admirable features. The arrow of time which points inexorably towards chaos is not the arrow of Christian thought, which points towards the coming kingdom of heaven. The Christian affirmation is that it was not possible for Christ to be held by death. There is a stronger law than the Second Law of Thermodynamics in God's providence.

However, there is much to be learned from the science in this splendid book, as indeed there is much to be learned from its very human author. ✣

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When I consider your heavens,
the work of your fingers,
the moon and the stars,
which you have set in place,
what is man that you are mindful of him,
the son of man that you care for him?
You made him a little lower than the heavenly beings
and crowned him with glory and honor.

—Psalm 8:3-5 (NIV)

Book Reviews

THE COSMIC BLUEPRINT by Paul Davies. New York: Simon & Schuster, 1988. 224 pages, references, index. Hardcover; $17.95.

Paul Davies is Professor of theoretical physics at the University of Newcastle upon Tyne, with a doctorate from the University of London. He is a prolific writer with more than a dozen books in technical and non-technical aspects of physics. Recent popular publications include *Superforce, God and the New Physics*, and *The Edge of Infinity*.

Science has been dominated for centuries by the mechanistic paradigm of Newton which, coupled with thermodynamics, leads to the Second Law of Thermodynamics. This has been interpreted to mean that the universe is winding down and will ultimately end in a heat death, an idea that Davies finds distressing. As an alternative he proposes a new paradigm, that the universe is progressively self-organizing, that "there must be new general principles—organizing principles over and above the known laws of physics—which have yet to be discovered." These new principles cannot be deduced by reductionist methodology but refer to the collective properties of complex systems. Most of modern science and technology has been based on models derived from simple systems; linear systems that are at or near equilibrium. Living systems cannot be modelled in this traditional way for at least four reasons: (1) they are complex and complexity appears abruptly, not by slow continuous evolution; (2) they have a large number of degrees of freedom; (3) they are open systems; and (4) they are nonlinear. In fourteen chapters, Davies introduces many concepts in his development of this central theme, that a general property of complex systems (living organisms) is that "new qualities emerge that are not only absent, but simply meaningless at a lower conceptual level." Concepts that might be unfamiliar to the reader like dissipative systems, fractals, chaos, Feigenbaum's numbers, self-organization, and the inflationary universe are presented in an interesting and comprehensible manner.

Davies is an excellent teacher, but he has strong opinions which show up in his writing. For example, he is highly critical of "most modern biologists" who are mechanistic and reductionist. On the evolution of the eye, which Darwinists assume occurred by "a systematic accumulation of myriads of mutations," Davies comments: "After all, half an eye would be of dubious selective advantage; it would, in fact, be utterly useless." If you are familiar with *The Blind Watchmaker* by Richard Dawkins, you might find this book to be a rebuttal of his entire thesis. For example, Davies quotes Francis Crick for a picturesque description of DNA: "DNA molecules are the 'dumb blondes' of molecular biology—well suited to reproduction, but not much use for anything else." Davies is convinced that complexity in living organisms has resulted from non-random abrupt transitions that occur when systems are forced away from equilibrium at critical points. In fact, this history of the universe could be summarized as a succession of symmetry breaks as the temperature decreased following the Big Bang.

I found Davies' writing to be filled with quotable statements:

> It should be stated at the outset that the origin of life remains a deep mystery.
>
> A review of current thinking on the origin of life problem reveals a highly unsatisfactory state of affairs.
>
> The very fact that the universe is creative, in other words has organized its own self-awareness, is for me powerful evidence that there is "something going on" behind it all.

Davies uses very interesting sub-headings for many of the topics discussed, for example: "What happened to time?", "A gambler's Charter," "Magic numbers," "The nearest thing to nothing known to man," "Matter with a will of its own," "Quantum weirdness and common sense," and "Patterns that think."

I enthusiastically recommend this book to ASA members. While there are a significant number of points where I do not agree with Davies, the book is still challenging and well worth the time spent in reading it. For example, some of his philosophical interpretations of quantum theory do not square with my understanding from quantum chemistry. In a sense, the book is frustrating, since while Davies is overwhelmed by the impression of design in the universe, he is searching for an explanation that will eliminate the metaphysical. Yet Davies is aware that there is "something going on behind it all." Readers of *Perspectives* well know the "meaning" referred to in the statement with which Davies concludes his book: "Science may explain all processes whereby the universe evolves its own destiny, but that still leaves room for there to be a meaning behind existence."

Reviewed by Bernard J. Piersma, Professor of Chemistry, Houghton College, Houghton, NY 14744.

CREATION AND SCIENTIFIC EXPLANATION by W.P. Carvin (volume 10 in "Theology & Science at the Frontiers of Knowledge" series). Edinburgh, Scotland: Scottish Academic Press, 1988. (Distr. by Gower Pub. Co., Brookfield, VT.) 106 pages. Hardcover; $16.95.

This book is about scientific cosmologies and their relationship to the biblical doctrine of creation. Cosmologies are attempts to build the widest and most comprehensive system of explanation for the universe which

we observe all around us. Throughout recorded history the prevailing cosmologies have changed drastically; they are limited by observation, and are therefore likely to need modification as new modes of observation become possible. Despite these changes, Walter P. Carvin seeks to show that in each historical era, the current scientific cosmology appropriately serves as a jumping-off point for theological reflection on the nature of God, specifically God as creator of the universe. In the context of cosmologies, science and religion have some similar concerns (in fact, Carvin argues that this is one of the closest contacts between science and faith), since they both ask the questions: why are things as they are? and; what are their origins? While scientific and religious answers to these questions reflect alternate systems of explanation, occasionally they may inform one another. For example, cosmologies might well be partially shaped by religious faith, such as confidence in the biblical revelation of orderliness in the created world.

Three-quarters of this book is given over to a very thorough analysis of Aquinas's theology of creation seen against the background of Aristotelian cosmology, and the thought of Leibniz against the background of Descarte's modified Cartesian cosmology. From these examples Carvin argues that when Christians today speak about creation and the created world they should specifically address the universe as currently understood; i.e., according to Einstein, and even now under some revision by Hawking *et al.* Christians should have a deep concern here because of the so-called cosmological and teleological arguments for the very existence of God. These arguments are posed by particular answers to the following respective questions: Why is there *something* here rather than nothing? And, why is there *this* something and not something else? That God the Creator is somehow part of the answer to each of these questions is a very powerful and significant Christian apologetic argument, although it does not of course constitute a logical proof for His existence.

Carvin is a Baptist minister and part-time college professor, teaching Religion and Philosophy. He received undergraduate training, and has an ongoing interest, in math and physics. He is anxious to pursue and develop a dialogue between science and theology, and in this book he has done an excellent job of bringing together scientific cosmologies and theologies of creation. While biblical faith in "God the Creator, Maker of heaven and earth," can never be tied to a particular cosmology, there is great benefit in thinking through the expanded general revelation of God available to us in scientific cosmology.

Reviewed by Ian Johnston, Associate Professor of Biology, Bethel College, St. Paul, MN 55112.

CHRISTIANITY AND THE NATURE OF SCIENCE: A Philosophical Investigation by J.P. Moreland. Grand Rapids, MI: Baker Book House, 1989. 263 pages, bibliography. Paperback.

Books Received and Available for Review

(Please contact the book Review Editor if you would like to review one of these books.)

L. Bouyer, *Cosmos: The World and the Glory of God*, St. Bede's Pub.
R. Burhoe, *Toward a Scientific Theology*, Christian Journals Ltd.
J. Carmichael, *The Birth of Christianity: Reality and Myth*, Hippocrene Books
J. Cooper, *Soul and Life Everlasting: Biblical Anthropology & the Monism-Dualism Debate*, Eerdmans
D. Cupitt, *The Sea of Faith: Christianity in Change*, Cambridge
F. Darling, *Biblical Healing: Hebrew and Christian Roots*, Vista
D. DeYoung, *Astronomy and the Bible*, Baker
V. Eller, *Christian Anarchy: Jesus' Primacy Over the Powers*, Eerdmans
M. Ellingsen, *The Evangelical Movement: Growth, Impact, Controversy, Dialog*, Augsburg Press
J. Erickson, *The Living Earth: The Coevolution of the Planet and Life*, Tab Books
J. Fahey & R. Armstrong (eds.), *A Peace Reader: Essential Readings on War, Justice, Non-Violence and World Order*, Paulist Press
H. Fritzsch, *The Creation of Matter: The Universe from Beginning to End*, Basic Books
W. Garrett (ed.), *Social Consequences of Religious Belief*, Paragon House
N. Geisler, *The Battle for the Resurrection*, Nelson
N. Geisler, *Knowing the Truth About Creation*, Servant
G. Graber & D. Thomasma, *Theory and Practice in Medical Ethics*, Continuum
K. Ham & P. Taylor, *The Genesis Solution*, Baker
C. Hansel, *The Search for Psychic Power: ESP and Parapsychology Revisited*, Prometheus Press
J. Houghton, *Does God Play Dice? A Look at the Story of the Universe*, Zondervan
S. Jaki, *The Absolute Beneath the Relative and Other Essays*, University Press of America
J. Loder, *The Transforming Moment*, Helmer & Howard
F. Loewenberg, *Religion and Social Work Practice in Contemporary American Society*, Columbia
J. Mangum (ed.), *The New Faith-Science Debate*, Fortress Press
G. May, *Addiction and Grace*, Harper & Row
V. Miceli, *The Roots of Violence*, Christopher Pub. House
R. Nash, *The Rights of Nature: A History of Environmental Ethics*, Wisconsin University Press
J. Polkinghorne, *Science & Providence: God's Interaction with the World*, New Science Library
C. Ross, *Common Sense Christianity*, Occam Publishers
J. Silk, *The Big Bang*, Freeman
J. Smith, *Did Darwin Get It Right? An Essay on Games, Sex and Evolution*, Chapman & Hall
M. Spiegel, *The Dreaded Comparison*, New Society Publ.
I. Stewart, *Does God Play Dice? The Mathematics of Chaos*, Basil Blackwell
G. Tinder, *The Political Meaning of Christianity*, LSU Press
S. Vicchio, *The Voice from the Whirlwind: The Problem of Evil and the Modern World*, Christian Classic
L. White, *The Merchants of Death: The American Tobacco Industry*, Morrow

As a Christian working in science, have you ever thought about the dichotomy that has developed in the 20th century between our religious beliefs and the accepted practice of science? This is perhaps best illustrated in the well-publicized ruling of Judge William Overton in the Little Rock case in which he stated, among other things, that science must be guided by natural law and

explained by reference only to natural law. I have been troubled for some time that naturalism and reductionism appear to have entered into science in an arbitrary way and now are the only acceptable ways to characterize science.

J.P. Moreland has been troubled enough to say something about it. As professor of philosophy at Liberty University with a B.S. in chemistry, graduate degrees in theology and philosophy, and a Ph.D. in philosophy from USC, he is well qualified to speak to us on this issue. Moreland does have in mind to demonstrate that creation science can, in fact, be science, but his book is much more than that. He has developed this attempt at integrating science and Christian faith by expanding a chapter from his previous book, *Scaling the Secular City*. Moreland attempts to defend three theses in this book: (1) that science cannot be defined in such a way that makes it distinct from other non-science fields of study; (2) that because of limits to science, scientism (science is the only rational way to obtain truth) is false and science is not dominant over other disciplines like theology and philosophy; and (3) that to assume a realist view of science (i.e., that scientific theories are true or approximately true models of the world) is not the best approach for integration of science and theology, and that an eclectic model of science is to be preferred.

This "philosophical investigation" is developed in five chapters. Chapter 1 is a discussion of attempts to define science, including a detailed critique of Judge Overton's definition, and concludes that questions of definition are really in the realm of philosophy, not science. This chapter also shows that "theological concerns are important to science at several levels." Chapter 2 demonstrates that science uses a group of methodologies "capable only of broad characterization," rather than the scientific method, which is fiction. Moreland maintains that science has no exclusive rights to knowledge by virtue of a special methodology which is not available to other disciplines. While I found reading this chapter a bit tedious, I found it very helpful and well done.

Chapter 3 discusses "The Limits of Science," and is the best presentation of this subject that I have read. Chapters 4 and 5 explore "Scientific Realism" with various objections raised by this view of science, followed by "Alternatives to Scientific Realism." I found much to think about in these chapters and some ideas that are difficult to accept. Perhaps most troubling for me is Moreland's proposal of an "eclectic approach to science that adopts a realist/antirealist view on a case-by-case basis." He suggests that "for example, when science and a theological statement or biblical interpretations came into conflict, part of the solution may lie in adopting an antirealist view of the scientific statement" (p. 205). Two criteria are suggested to determine when an antirealist view of a scientific theory should be adopted. Moreland maintains that when conflicts arise between science and theology (or any other discipline) it may not necessarily be adjustments that are required in the field other than science. Perhaps the science needs to be modified or viewed in antirealist terms.

Chapter 6, "The Scientific Status of Creationism," applies what has been developed in the preceding sections to the creation-evolution conflict. It is important to note that this discussion does not focus on evolution of the scientific evidence. Moreland states that the creation-evolution debate should be seen "not only as a difference regarding scientific facts, though it includes that, but also as a conflict over epistemic values" (p. 245). He views the debate from the 19th century up to the present as a "largely philosophical debate about how to view science, theology, man, morality, and the cosmos."

In spite of some minor distractions, like seemingly forced use of the feminine personal pronoun, I am enthusiastic about this book. I think it presents some important ideas that we, as Christians working in science, need to explore and discuss. The book should be very suitable for use as a text in a science course for non-science students, and I intend to use it for such a course. I strongly encourage you to read this book, even though you'll probably not agree with everything that Moreland says. What he has to say is well worth the hearing.

Reviewed by Bernard J. Piersma, Professor of Chemistry, Houghton College, Houghton, NY 14744.

SCIENTIFIC DISCOVERY: Computational Explorations of the Creative Process by Pat Langley, Herbert A. Simon, Gary L. Bradshaw and Jan M. Zytkow. Cambridge, MA: The MIT Press, 1987. 357 pages. Paperback; $9.95.

The process of scientific discovery is one of the most fascinating problems in the methodology and psychology of science. The authors of *Scientific Discovery* attack the problem head on by stating that this process can be rather easily unveiled and simulated on the computer.

The authors deny an inspirational or intuitive character of discovery. For instance, after giving a simple example of a sequence of letters they say that its extrapolation is understood as using relations stored in the long-time memory. One can ask now: What about these relations? In what way were they acquired if intuition is disposed of?

The authors rely on the "faith in some kind of continuity and simplicity of nature" (p. 58). Was this faith retrieved directly from empirical data? If so, the word "faith" would be here somewhat inadequate. The same goes for "certain convenient properties"—specifically symmetry and conservation (p. 170). Did they emerge from simple Baconian induction? The authors maintain that basic processes of scientific discovery are normal problem-solving processes tailored to a particular domain, and the notion of intuition "can be explained quite straightforwardly in terms of information processing" (p. 38). How would they explain, however, problem-solving heuristics and information processing itself? Would it be

so straightforward? It is an old egg and chicken problem that most often is simply avoided rather than solved.

The authors discuss in great detail a series of computer systems that make discoveries—or rather rediscoveries. The first group of programs includes BACON.1 through BACON.5 that—like their eponym—accentuate the importance of data, only numerical data, and induction as the primary (if not the sole) tool for deriving laws. Discoveries are data driven and their structure is represented—only to a limited extent—in BACON.5. In order to grapple with qualitative data and qualitative laws, the system GLAUBER had been developed (in fact, two versions of this system). All these systems have been tested and were able to rediscover some simple laws of chemistry and physics.

BACON and GLAUBER focus on the individual aspect of the discovery process by trying to make explicit some mental processes of the discoverer. That leads, among other things, to somewhat dubious comparisons between the rate at which BACON.3 makes a discovery and the rate of that process in humans (pp. 111-113). The authors, however, admit that "although the successful rediscovery of ... a law by BACON certainly demonstrates one path to that discovery, it does not demonstrate that this path was taken historically" (p. 224). Therefore, emphasizing "a historical sequence of discoveries" or "a collective subject over spans of decades" (p. 243) rather than isolated events seems to be more appropriate and methodologically more fruitful.

As a result, system STAHL has been created. This system is probably the most interesting of all discussed in the book because it tries to account for errors encountered in the 18th century, when the phlogiston theory was a widely accepted paradigm in chemistry. STAHL determines the components of chemical substances, phlogiston being one of them. Another system, DALTON, goes into more detail in analyzing the structures of substances, as it also determines the number of atoms taking part in a reaction.

Presentation of BACON, GLAUBER, STAHL, and DALTON is the main part of the book. The systems are described and discussed in much detail including their strengths, weaknesses, and interrelations. This part of the book is a valuable contribution to artificial intelligence (AI), but many of the authors' philosophical statements are at least disputable if not farfetched or unacceptable. The authors' tendency to demystify creative processes leads them to simplifications and reducing these processes to merely mechanical operations. Because it has already been perceived that bringing AI up to the level of human intelligence is futile, a regrettable tendency seems to gain popularity: that of bringing man down to the level of the machine.

Working systems that model human reasoning do not guarantee that the model is adequate (the system ELIZA is an excellent example). Such systems remain mere guesses that try to simulate the living system, the brain, whose complexity by far surpasses the capabilities of any machine and any AI system. Is it only a quantitative difference? This is at least questionable.

Reviewed by Adam Drozdek, Professor of Computer Science, Duquesne University, Pittsburgh, PA 15282.

FROM KNOWLEDGE TO WISDOM: A Revolution in the Aims and Methods of Science by Nicholas Maxwell. New York: Basil Blackwell, 1984. 298 pages, name index. Paperback; $15.95.

As the subtitle of this book implies, the author has written a lengthy argument for what he considers to be "a profound and comprehensive intellectual revolution, affecting to a greater or lesser extent all branches of scientific and technological research, scholarship and education" (p. v). Maxwell contends that science, as it is currently practiced, functions under what he refers to as a "philosophy of knowledge." It is the author's thesis that this philosophy is lacking in numerous ways and needs to be replaced by what he calls a "philosophy of wisdom."

The philosophy of knowledge is defined by the author in the following manner:

> The proper aim for rational inquiry is to acquire knowledge about the world, objective knowledge of truth. Ultimately, no doubt, knowledge is sought as a means to the end of achieving that which is humanly desirable and of value. At the most fundamental level of all, in other words, the aim of rational inquiry may well be to help promote social progress, human welfare and enlightenment. In order to achieve these fundamental human, social aims, however, it is essential that rational inquiry devotes itself, in the first instance, to achieving the purely intellectual aim of acquiring objective knowledge of truth. Only by dissociating itself decisively from the goals, values and beliefs of common social life ... can inquiry accumulate genuine knowledge, thus ultimately being of benefit to humanity. Rational inquiry must, as it were, ignore human need in order to help fulfil such need. Truth, not that which is humanly desirable, must be the central intellectual concern of rational inquiry. (p. 10)

This is, of course, a basic description of the detached, objective, empirical nature of science. Maxwell objects to this philosophical basis of science because it separates science from humanity. He states that this philosophy sharply separates scientific inquiry from the influence of "all kinds of psychological, sociological, economic, political, moral and ideological factors and pressures which tend to influence thought in life, in society" (p. 16). He further contends that "feelings, desires, human social interests and aspirations, political objectives, values, economic forces, public opinion, religious views, ideological views, moral considerations, must not be allowed, in any way, to influence scientific or academic thought within the intellectual domain" (p. 16).

Maxwell proposes to replace this currently held philosophy with another, the philosophy of wisdom. The philosophy of wisdom as proposed by the author, holds

> that inquiry, in order to be rational, in order to offer us rational help with realizing what is of value, must give absolute intellectual priority to our life and its problems, to the mystery of what is of value, actually and potentially, in existence, and to the problems of how what is of value is to be realized.... The central and basic task of rational inquiry ... is to help us imbue our personal and social lives with vividly imagined and criticized possible actions so that we may discover, and perform where possible, those actions which enable us to realize what is of value—happiness, health, sanity, beauty, friendship, love, freedom, justice, prosperity, joy, democracy, creative endeavour, cooperation and productive work. (pp. 65-66)

Thus, the author sees science, as it is currently conducted (under a philosophy of knowledge) as lacking in personal, value-oriented components. He proposes that this revolutionary idea (i.e., the philosophy of wisdom) will promote a more personal and value-oriented emphasis in all aspects of science, technology, and education. This book is a long and elaborate argument intended to convince the reader of this need.

Personally, I can see some merit to the author's thesis. The problems facing us today—nuclear war, environmental issues, bioethical and biotechnological questions, as well as others—must be considered in light of ethical, moral, and value systems. Yet a very basic question remains: Which system of values, morals, or ethics will we use? There is no consensus of opinion in our world today. At one point the author attempts to go back historically to scientists such as Newton, Faraday, and Clerk Maxwell as examples supporting his thesis. He fails to point out, however, that these men held to a very definite value system. They all lived and practiced their science under the basis of the Christian system of morality and values. Unfortunately, that system is not universally accepted today.

Further, Maxwell fails to understand that the analytical, objective, empirical nature of science is essential for science to function as science. That is not to say that other aspects of human existence do not have a place in scientific endeavors, or that values and morals are not important. But, at the level of basic research, science must maintain its empirical nature.

Phillip Eichman, Muncie, IN 47304.

SCIENTIFIC CONTROVERSIES: Case Studies in the Resolution and Closure of Disputes in Science and Technology by H. Tristram Engelhardt, Jr. and Authur L. Caplan (eds.). Cambridge: Cambridge University Press, 1987. 639 pages, index. Paperback.

The editors of this book have brought together essays written by over 30 individuals. This group is composed of scientists, philosophers, ethicists, historians and philosophers of science, physicians, and others. The book is the result of a conference project which extended from 1978 to 1982. From 1982 until the publication of the book, the materials were further refined to the present form.

The primary goals of the project were to study the relationships between science and society, specifically in regard to how scientific controversies are resolved. As the authors clearly point out these controversies reach beyond pure science into areas of ethics, economics, politics, and other societal issues.

Following a general introduction by the editors, the book is divided into three parts. In Part I, "Theoretical Perspectives," the authors discuss primarily historical and procedural aspects of these areas of dispute. Special emphasis in this part, and throughout the book, is given to "closure" which is defined by the editors as " ... the conclusion, ending, or resolution of a controversy."

The essays in Part I range over a broad area of topics primarily of a philosophical and historical nature. Specific essays, for example, discuss various types of controversies and how closure occurs. Others deal with historical topics such as the eugenics movement in the United States and the debate over the Continental Drift Theory of Alfred Wegener.

Part II is entitled "Contemporary Case Studies." In this section four areas of controversy are discussed. These are: (1) the use of Laetrile in the treatment of cancer, (2) the classification of homosexuality as a disease, (3) safety in the workplace, and (4) the safety of nuclear power. Each topic is discussed by several authors and various aspects of the problem are explored.

Part III, "Controversy, Closure, and the Public," provides a summary and conclusion to the book.

This is a lengthy and detailed book. Readers may have an interest in only one or two of the many topics covered in the book. Each essay has footnotes to help the interested reader in further study. There is no general bibliography, however. There are two very complete indexes, one of authors and the other for subjects.

This is not a book for casual reading. It is scholarly and extensive in coverage of the subject. It should be useful as a reference work for all those interested in this aspect of science.

Reviewed by Phillip Eichman, Muncie, IN 47304.

TO TREAT OR NOT TO TREAT: Bioethics and the Handicapped Newborn by Richard C. Sparks, C.S.P. Mahwah, NJ: Paulist Press, 1988. 337 pages, index. Paperback; $9.95.

Sparks, a Paulist priest and currently Assistant Professor of Christian Ethics at the College of St. Thomas and

St. Paul School of Divinity in St. Paul, Minnesota, has written an admirably thorough and complete analysis of the ethical considerations relevant to problems concerning the treatment of the handicapped newborn.

Recognizing that there is a broad spectrum from the anencephalic baby on the one extreme—whom almost everyone would agree should be exempted from further life-sustaining efforts—to a Down's Syndrome baby with digestive blockage—whom almost everyone would agree should be treated—on the other, the author poses the difficult questions that have to be faced in treating the wide range of cases inbetween. He also recognizes that there are several fundamental questions regarding the medical treatment of non-competent patients, such as: (1) Who decides? (2) On what basis is the decision made? (3) What is the next step if therapeutic efforts are abandoned? and (4) What should be public policy? The author focuses in this book almost completely on the second of these questions, by asking the fundamental question: "On what basis is it moral to forego or cease further treatment for a handicapped newborn?"

The book focusses on four major approaches to the answers to this question in four major chapters of about equal length: (1) "A Medical Indications Policy," (2) "A Means-Related Approach to Ordinary/Extraordinary Means," (3) "Projected Quality of the Patient's Life," and (4) "Socially-Weighted Benefit/Burden Calculus." In each chapter, the author brings together the writings of a number of pertinent scholars, offers case applications to illustrate the principles, and offers a critique of the major strengths and weaknesses of that position. In a concluding chapter, the author offers his own position, developed in the interaction with the positions previously discussed. The book presents an extremely complete review and synthesis of the literature on the subject, with notes and references at the end of each chapter, the total length of these notes being about 20% of the whole book.

Given the completeness of the treatment, it is virtually impossible to offer an adequate summary of the major points. If one were to attempt a brief characterization, it would go something like this.

The advocate of a "Medical Indications Policy" argues that "access to society's health care facilities and resources ought to be based *solely* on biological need" (p. 21). Perhaps the leading advocate is Paul Ramsey, whose perspective the author attributes to his "Barthian-influenced, Protestant-based theology" (p. 54). Ramsey argues that "the anthropology adopted by Thomas Aquinas and accepted in large measure by the Roman Catholic tradition espouses a more dynamic, multi-faceted concept of the human person and of his/her well-being" (p. 55).

Advocates of "A Means-Related Approach to Ordinary/Extraordinary Means" follow a developing construct of Roman Catholic medical ethics.

> The ordinary/extraordinary means standard in its contemporary expression is an attempt to ride a middle course between a medical indications policy, which it sees as restricting the patient's right to refuse excessively burdensome means, and a "slippery slope" quality of life ethic, which it sees as jeopardizing an individual's right to life by judging persons as "extraordinary" and expendable as opposed to judging means in relation to given patient-persons. (p. 100)

Advocates of a "Projected Quality of the Patient's Life," raise the fundamental question, "When, if ever, is the quality of one's life so inordinately wretched *for the patient*, regardless of potential medical benefit and regardless of whether the means cause or merely perpetuate such burden, that death or at least a shorter life span is to be welcomed, not forestalled?" (p. 156).

Most advocates of a "Socially-Weighted Benefit/Burden Calculus" exhibit a "willingness to over-ride a given newborn patient's individual interests in the name of a socially-weighted benefit/burden calculus" (p. 268). While recognizing the legitimacy of some of the concerns, the author expresses the conviction that such advocates "give too little significance to the inherent or intrinsic value of human beingness, opting to hinge personal rights and corresponding moral responsibilities too heavily on one's functional potential or social utility" (p. 258).

Walking carefully on the tightrope that spans these options, the author argues cogently for a position that centers at about the median of the third position described above. He defends "a nontreatment approach hovering between that espoused by the 'more restrictive' and the 'broader' interpreters of the projected quality of the patient's life standard" (p. 278).

Readers of this book may be overwhelmed by the constant references to large numbers of writers and experts in the field. But they will come away with a new appreciation for the nuances of the opinion, the wide range of proposed options, and a sense of the complexity of applying any simple position consistently in the real and complex world. The author has performed a genuine service, and the book deserves to be widely read and discussed.

Reviewed by Richard H. Bube, Professor of Materials Science & Electrical Engineering, Stanford University, Stanford, CA 94305.

THE WAR AGAINST POPULATION: The Economics and Ideology of Population Control by Jacqueline Kasun. San Francisco, CA: Ignatius Press, 1988. 225 pages, index. Paperback.

Contrary to the idea that there is a population explosion leading to disaster, this writer maintains that the earth could feed 35.1 billion people, and "there is very little probability of running out of anything essential to the industrial process at any time in the foreseeable future." The author is a professor of economics at Humboldt State University in Arcata, California, and has

documented her beliefs with extensive references. She calls overpopulation the unexamined dogma, and maintains that population growth is economically beneficial.

Government publications claim that "ocean fisheries, grasslands, forests and croplands are being strained by rapid population growth to the point where, in some cases, they are actually losing productive capacity." But the author's data show that "world food production has increased considerably faster than population in recent decades."

A chapter on United States Foreign Aid and Population control maintains that the United States exceeds all other countries in contributing to foreign-control programs and pressures other countries to back the programs, which arouses antagonism where the U.S. needs friendship.

Government policy promotes sex education in schools to lead to a restriction in reproduction. Details of a typical program for seventh and eighth graders are given. Kasun, mother of two daughters and a son, considers these programs a "determined assault on the family," which lessens the programs' attractiveness, discredits their moral authority, and denigrates traditional religion.

After evaluating the programs dealing with adolescent pregnancy and abortion, subjects treated by our author in other publications, she concludes: "Adolescent-pregnancy controllers have no standards of value, or of method, other than to reduce fertility, and to that end they do not hesitate to distort the facts or to use means that intimidate and flirt with coercion." Kasun also summarizes the activities and ideals of 35 organizations devoted to limiting the human population.

The concluding chapter is "Government Family Planning Now and In the Future": "The Government family planners aspire not only to exert more control over those whom they ostensibly serve—the young and the poor and the minorities—but also over those who are forced to support the programs by taxation." The author believes universities will continue to advocate population planning partly because of "financial sweets for research, as they face the drops in enrollment that a declining birth rate promises."

This book is a must for those of us who have been led to teach about the population crisis. You may also wish to read another book of the Ignatius Press, *Too Many People?* by Christopher Derrick, an English author (reviewed in *Perspectives* Dec. 1989).

Reviewed by Russell L. Mixter, Professor Emeritus of Zoology, Wheaton College, Wheaton, IL 60187.

ECOLOGY AND LIFE: Accepting Our Environmental Responsibility by Wesley Granberg-Michaelson. Waco, TX: Word, 1988. 200 pages, index. Hardcover.

A valuable feature of this book is the inclusion of six articles by different authors evaluating the cause and cure of our ecological crisis, five of them evaluating Lynn White, Jr.'s criticism of the idea that biblical theory has caused our environmental difficulties. Also added is an "Implication Document" by the North American Conference on Christianity and Ecology.

Wesley Granberg-Michaelson is president of New Creation Institute, previously chief legislative assistant to Senator Mark Hatfield, and managing editor of *Sojourners* magazine. This book is the second in a series of Issues of Christian Conscience, whose general editor is Vernon Grounds.

After listing many cases of deterioration of the environment, the author claims the church should "provide the stimulus to challenge the culture's prevailing attitudes of exploitation and offer the culture a persuasive vision for altering its stance toward the creation." Against the assumption that the creation for humanity's benefit is the biblical view that the creation exists for God's glory: "all parts of the creation, not just humanity, are pictured as praising God's glory with thanksgiving and joy." Many scripture references are given to support this view.

Hopeful signs are seen in the conferences and institutes of recent years. Much provided by technology is valuable but dangers of its reign are: modern society has come to place a fundamental faith in technology itself; society assumes that technological knowledge is omniscient; technology has imposed its own rules as society's features; and technological ends have become translated into society's goals.

Engineering life by gene therapy could offer cures to certain genetic diseases but the author doubts "that humanity knows enough to restructure the basic forms of life in the animal kingdom," and to do it "simply for the sake of profit is morally offensive and wholly unwarranted."

A chapter on "This Creation and the new Creation" emphasizes that "the promise of the new creation can no more be severed from this creation than Christ's divinity can be severed from his humanity," and that God's original intended purposes of creation be fulfilled. The final chapter on "Life and Death" concludes that "the church can offer to the world a hope that is rooted in the power of God to bring new life into all that has been created."

Ecology and Life is a valuable treatment of attitudes toward our environment. Your appreciation of our world will be enhanced by reading it.

Reviewed by Russell L. Mixter, Professor Emeritus of Zoology, Wheaton College, Wheaton, IL 60187.

NEW AGE MEDICINE: A Christian Perspective on Holistic Health by Paul C. Reisser, Teri Reisser, and John Weldon. Downers Grove, IL: InterVarsity Press, 1987. 204 pages, appendix, notes, bibliography, indices. Paperback; $7.95.

Paul Reisser is a general practitioner, and his wife, Teri, is executive director of a crisis pregnancy center. The third author, John Weldon, is a researcher of the New Age movement. He has written or coauthored several books including *Psychic Healing* and *Playing With Fire*. Reisser's medical background and John Weldon's knowledge of the New Age movement allowed them to combine their areas of expertise and produce this book.

This book is a revised and expanded version of the 1983 book, *The Holistic Healers. New Age Medicine* contains the complete text of the previous book plus additional information regarding some of the controversial techniques that are popular now. The authors have also added some warnings to guide the patient to decide if a given therapy is worth embracing or is better off left alone.

New Age Medicine contains ten chapters which are split into four separate parts. In the preface, the authors detail a day at the annual conference of the Center for Integrated Medicine. The conference and the authors of this book have a message, though different in scope: medicine is changing.

The first three chapters (Part I) deal with "The Holistic Phenomenon," or what holistic medicine actually entails. Holistic medicine encompasses many different practices, but it seeks to deal with the "whole" being: the mind, the body, and the spirit. It claims if one of these areas is off, then the other two are also out of alignment. All holistic health techniques also deal with "energy," which comes with many titles such as Prana, Ch'i, Vital Energy, Universal Energy, or even The Force. The authors include ten basic precepts that are embraced by New Age medicine. A few of these are: health implies evolution; natural forms of healing are preferable to drugs and surgery; the thinking and practices of many ancient cultures are full of information for healthy living which is often superior to modern knowledge; and, health is more than just the absence of sickness.

In chapters 4-6 (Part II), the authors look more in depth at Ancient Chinese Medicine which is at the forefront of holistic medicine at this time. They explain the roots of Chinese medicine and how it is tied to Chinese religion: the Tao philosophy; the forces of Yin and Yang; and the universal, invisible life energy called Ch'i that flows through everything living. Chapter 5 deals specifically with acupuncture. Does it truly work? If so, by what means? Chapter 6 shows how popular therapies such as Touch for Health, applied Kinesiology, Jin Shin Do, and the Vitamin Test (which uses the Muscle Response Test) all come from Ancient Chinese Medicine.

"Psychic Diagnosis and Healing" are dealt with in Part III. The authors make the following point in this section: "Our desire is neither to spin sensational tales of spooks and chills nor to debunk all psychic events as foolishness or fancy. We encourage skepticism as a necessity for detecting con games and dubious cures, but we desire even more to create a healthy respect for what Scripture calls spiritual warfare—the invisible but deadly conflict whose battle lines are the psychics' stomping grounds." They discuss the careers of several psychic healers, among them Olga Worrall, a Brazilian psychic surgeon named Arigo, and the Sleeping Prophet—Edgar Cayce.

In the last section of the book, "Health for the Whole Person: A Balanced Approach," the authors discuss some New Age health practices which have become controversial and sometimes popular among Christians. They look specifically at Biofeedback (where the patient is helped to enter the Alpha state of consciousness to help control body functions), homeopathy (where extremely diluted solutions of symptom-causing substances are given to the patient to effect a cure), and iridology (where malfunctioning body parts are mirrored somehow in the iris of the patient's eye). The authors give some general principles or guidelines for deciding if an alternate therapy should be used by Christians. The authors end with a biblical foundation for health and wholeness. They suggest that if people would live by biblical standards, then there would be a major upheaval in health for the better.

I really appreciated the authors' helps at the back of the book. They went out of their way to make the book a quick reference book. It contains charts, recommended books for reading, chapter notes, a bibliography, both a subject and a name index, and a set of lists they call "Helps and Indices of Major Critiques and Analyses."

This book is intended for a general Christian audience and is easy and pleasurable reading. If the reader is knowledgeable of the New Age movement, then this information will not come as a surprise. However, some Christians currently using these techniques may have their eyes opened for them. I enjoyed this book and would recommend it to anyone concerned with holistic medicine or the New Age movement.

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Letters

Response to Marvin Kuehn's Letter (Dec. 1989)

I am writing in response to the letter by Marvin Kuehn (December 1989) expressing his views on Michael Denton's book *Evolution: A Theory in Crisis*. I certainly grant Kuehn the right to criticize this book, when the criticism is given

in a forthright manner without resorting to inflammatory rhetoric. However, I am concerned when I read the following: "whose claims to scholarship or integrity are woefully deficient"; "the same old creationist tactics and il-founded objections"; "Denton's lack of precision ... and expertise ... "; "The standard creationist tactic ... "; "ignored or dismissed by some sleight of hand ... "; "Denton's lack of intellectual acuity ... "; "Denton's major flaws lie in his scholarship and integrity"; " ... his citations of leading biologists often distort and twist their intent ... "; "infuriated by the unsustainable attacks on evolution ... "; " ... repulsive misuse of sources."

Why is it that Kuehn could not have criticized the book without resorting to phrases such as those quoted above? Although Kuehn makes various references to Denton's lack of scholarship and intellectual acuity, as nearly as I can tell, Kuehn is really saying that his opinion on these topics differs from that of Denton. Unfortunately, Kuehn does not give page citations for most of his criticisms, so it has been difficult to assess his charges of Denton's misuse of quotations. One quotation that I could check was the charge by Kuehn: " ... where he [that is, Denton] makes Halstead sound like a cladist." The quotation from Denton's book (p. 139) follows: " ... in the words of Beverly Halstead (no friend of cladism himself), that 'no species can be considered ancestral to any other' marks without question a watershed of evolutionary thought." Kuehn considers this to be a serious distortion. Is this really a distortion when Denton acknowledges that Halstead is not a cladist? This was the only citation given by Kuehn that I was able to identify in the book, so I could not check on others to see if they were twisted or distorted.

As one of those at the ASA-sponsored conference on "The Informational Content of DNA" held in Tacoma, Washington in June 1988, and one who met Michael Denton and listened to his presentations, I was greatly impressed. The charges of "Denton's lack of intellectual acuity ... " and "who claims to scholarship or integrity are woefully deficient ... ", I believe to be totally in error. Denton is a molecular biologist, and in this area, where I believe I have competence to judge, I consider his knowledge to be extremely up-to-date. Since I am a biochemist and a molecular biologist, I will leave to others to judge his expertise in some other areas of biology. However, I am extremely impressed that in this era of specialization, that one individual can write so well on a broad range of topics as Denton has in his book.

I will not attempt to evaluate Kuehn's critiques of Denton in all areas of biology, but I will take a few examples to point out what I consider to be unjust criticisms. Kuehn notes: "Perhaps the best example of Denton's lack of intellectual acuity can be seen in his handling of molecular homologies." I have just complete writing a paper on protein and nucleic acid homologies for another scientific journal, and I believe I can speak on this aspect with some expertise. First let me note that there is much disagreement as to what homologies in proteins and nucleic acids really mean, so there is clearly room for differences of opinion. Kuehn makes the following statement: "From the gross differences that both fish and mammals have from lamprey he fallaciously concludes that all vertebrate groups are equidistant from each other." This comment demonstrates Kuehn's misunderstanding of what Denton is really saying. The statement in question by Denton (p. 285) follows: "When the various terrestrial vertebrate groups, amphibia, reptile, or mammal, are compared with fishes, all are equally isolated." All one needs to do is to compare the difference matrices provided by Denton on p. 279, or the more complete matrices in Dayhoff's *Atlas of Protein Sequence and Structure*, and the reader will see the essential truth of Denton's statement. These groups are all isolated from fish and they are isolated from each other. Nowhere does Denton say what he is purported to have said in the quotation of Kuehn that I cited.

Kuehn also criticizes Denton for the mishandling of certain technical disputes within biology (e.g., punctuationalism, cladism, neutralism, etc.). I have read these portions of Denton's book carefully and could find no evidence of this mishandling. One should remember that in a book with a broad coverage of a topic, one cannot expect the technical detail that might be required in a manuscript that is limited to a single topic. Again there are clearly differences of opinion on these topics that Kuehn chooses to refer to as "minor technical disputes," but I believe the use of the terms "mishandling" and "lack of precision" in reference to Denton are inappropriate.

In conclusion, it should be evident that I disagree markedly with the view of Kuehn regarding Denton's book *Evolution: A Theory in Crisis*, and find myself in accord with the previous review of this book by T.E. Woodward (December 1988). Denton notes repeatedly throughout his book that he is aware that his views are controversial, but he has presented those views carefully with a considerable amount of evidence to support them. I believe it is time for those who support more traditional views of evolution to reexamine the data and acknowledge that no satisfactory scientific explanation has been provided for many questions dealing with origins; whether they be the origin of the universe, the origin of life, or the origin of the many types of multicellular life. We need more scientists like Michael Denton, who are willing to challenge "generally accepted theories." All theories need to be continually challenged; most will be found to be in need of some modification, while others may need to be discarded and replaced with a new theory that is more in accord with the facts. If there are not scientists among us who are willing to challenge prevailing theories, there is little hope for progress in science in the future.

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More on Michael Denton

My evaluation of Michael Denton's *Evolution: A Theory in Crisis* falls somewhere between "one of the most important (and controversial) works on evolution in this century" (T.E. Woodward's review, *Perspectives*, Dec 1988) and "a book whose claims to scholarship or integrity are woefully deficient" (M. Kuehn's letter, Dec 1989). One of Marvin Kuehn's examples of woeful deficiency sent me back to Denton's book and then to the library to look up the words of a leading biologist allegedly twisted by Denton. Kuehn wrote that in Denton's discussion on taxonomy, "he makes Halstead sound like a cladist!"

Despite a minor deficiency (no *Halstead* in the book's index) I found the sentence in question: "Whatever the future of cladism, the fact that a significant number of biologists in the 1980s are insisting, in the words of Beverly Halstead (no friend of cladism himself), that *'no species can be considered ancestral to any other'*[21] [emphasis added] marks without question a watershed in evolutionary thought" (Denton, p. 139). Clearly, Denton identified Halstead as not being a cladist. No woe there, except for convoluted sentence structure.

Before pronouncing woe on Kuehn's own scholarship or integrity, however, I thought I should check Denton's ref. 21 (of Ch. 6): B. Halstead (1981) "Halstead's Defence Against Irrelevancy," *Nature*, 292: 403-04. Sure enough, L. Beverly Halstead had used essentially those words in describing a booklet *he detested* from the British Museum (Natural History): "But the booklet includes the most amazing assertion of all, that no fossil species can be considered the direct ancestor of any other." References cited by Halstead enabled me to trace a fierce dispute over the cladistic approach of certain Museum exhibits. In those days Halstead, reader in geology and zoology at Reading University, evidently objected strongly to just about everything done by the South Kensington Museum, or at least by its Public Services Department.

My feeling is that Denton is technically in the clear because he identified Halstead as "no friend of cladism." Denton might better have quoted the booklet rather than Halstead's response to it. Yet Halstead was reacting to a claim made by enough biologists to cause a big fuss in the literature. My guess is that when Denton was writing, he had access to *Nature* but not to the Museum booklet itself. Or perhaps some editor (the one who left Halstead out of the index?) distorted what Denton actually wrote. At any rate, the deficiency hardly seemed woeful.

Halstead also stated that the "current drive against the concept of gradualism is motivated primarily by Marxists"—just the kind of innuendo frequently considered typical of "creationist" writings. Halstead expressed dismay at "the distortion of scientific data for ideological purposes" by fellow paleontologist Stephen Jay Gould. As I see it, the question raised by Denton's book is whether the concept of gradualism itself is primarily an empirical conclusion or a prior ideological commitment.

I checked out another of Kuehn's objections, that of important evidence "ignored or dismissed by some sleight of hand—see Denton's treatment of *Archaeopterix*." Using the index more successfully this time, I re-read everything Denton said about *Archaeopterix* without finding the "serious errors of logic, synedoches, direct misquotes, gross factual mistakes and even spelling errors" Kuehn led me to expect. (I assume that the misspelling of *synecdoches* in Kuehn's published letter was an editorial goof, one of those things that can happen even to good guys, hardly evidence of woeful deficiency in scholarship or integrity.) I did find the statement (Denton, p. 176) that *Archaeopterix* is an archaic bird with hints of reptilian ancestry—along with a warning that hints aren't enough to establish continuity. Has *Archaeopterix* actually been established as an ancestor of anything living today? Would it be a "gross factual mistake" to call all such ancestral relationships *inferences* rather than *facts*?

Kuehn said that Denton's typological perception of nature was "legitimately abandoned due to its lack of explanatory power." My impression is that Denton appreciates the great explanatory power of macroevolutionary theory. The problem is that the theory can explain imaginary relationships that might turn out to be false. U.C. Berkeley geneticist Philip T. Spieth (*Zygon* 22, No. 2, pp. 252-7, June 1987) began an earlier review by saying that Denton's book "belongs to the 'creation science' genre." When stripped of its "cloak of respectable terminology," Spieth wrote, Denton's case is nothing more than the old argument of gaps in the fossil record. Nowhere in all the current debates over gradualism, Spieth asserted, "is the issue of genealogical relatedness brought into question." Is that a way of saying that certain scientists are so sure they're right that they don't worry about an empirical basis for their theory building?

A more recent review by William M. Thwaites (*NCSE Reports* 9, No. 4, pp. 14- 17, Jul-Aug 1989) called Denton's book "just another typical anti-evolution tract." Thwaites wrote that Denton is motivated "not by a desire to understand the workings of nature" but by an apparent fear of the "materialistic" and "skeptical outlook of the twentieth century." Thwaites took Denton's drawing of a two-dimensional map of hemoglobin relationships and showed that "If one makes the simple assumption that the sequence differences represent the time since the two organisms last shared a common ancestor, one can construct a vertical dimension. ... Presto! we have a phylogenetic tree." No one doubts that phylogenetic trees *can* be constructed if one makes certain simple assumptions. What Denton (and other critics of macroevolutionary theory) point out is that such trees *are* constructs, and are accepted "without bringing the issue of genealogical relatedness into question" (Spieth). In other words, genealogical relatedness is an *a priori* assumption, not something empirically established.

I met Michael Denton in June 1988 at a conference on the information content of DNA sponsored by ASA's Committee for Integrity in Science Education. I saw no evidence that he was any kind of "creationist" or any

less competent than his reviewers, particularly in his own field of molecular biology. Further, I got the impression that he considers macroevolution a reasonably plausible inference that might turn out to be true. His current interest seemed to center on the potential of genetic engineering techniques to produce new organisms that could at last put neo-Darwinian mechanisms to empirical tests.

Scientists tend to admire, even revere, the explanatory power of theories—at least until some plausible theory readily explains something we know to be false. The authors of ASA's *Teaching Science in a Climate of Controversy* were amazed to read what negative reviewers of that 1986 booklet said about the motivations of its authors, and to see how easily one reviewer's unfounded inference could become another's established fact. Perhaps my experience as one of those authors has sensitized me to these issues.

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Response to "The Word Maze"

The Word Maze column in the Sept. 1989 issue of *Perspectives* on the subject of "life/death" promotes the following observations.

Life/death can fruitfully be defined, as you did, in three different areas: the biological, the personal, and the spiritual. Taken singly, if I am alive biologically but "dead" personally and spiritually, I am in an irreversible, and relatively temporary coma, headed for both the grave and hell fairly soon. If I am alive personally but dead biologically and spiritually, I am in hell, or in the waiting state immediately before final consignment after the judgement. If I am alive spiritually, but dead biologically and personally, then I am in the state the Seventh Day Adventists think is the waiting state for redeemed souls before the resurrection, called soul sleeping to them, also a temporary state. None of these single conditions are normal.

Taken in pairs, the understanding becomes more fruitful. If I am alive biologically and personally but dead spiritually, then I am the usual garden variety of human—non-Christian. If I am alive biologically and spiritually but dead personally, then I am a redeemed person in a coma, a short-term state. If I am alive personally and spiritually but dead biologically, then I am "absent from the body but with the Lord," waiting for the resurrection. This is the traditional view of the state of the redeemed immediately after death, a relatively temporary condition. All of these paired conditions are temporary.

If I am alive biologically, personally, and spiritually then I am a normal redeemed person, or perhaps a resurrected, redeemed person. To accept this latter, then we must stretch our concept of biological to include the unknown future nature of the redeemed body we shall be given. If I am dead biologically, personally, and spiritually, then I do not exist—I am annihilated, a condition that the scriptures seem to rule out. Once I exist, I exist.

I have long used the communication model to describe personal "life" to a thinking person. The "I" needs a body to communicate with other persons and needs a spiritual "body" to communicate with other spiritual persons. Communication cannot proceed otherwise. If a person's body dies before he is given a permanent spiritual "body," then he will be given a temporary one, only long enough to stand for the judgement, after which he will have to endure endless isolation. To be isolated forever with the prurient memories intact and with the wicked tendencies now unchecked by God and unrestrained by society, this is the hell of hells. However benign the beginning, it will not take more than a few decades for even the strongest ones to experiment with evil. This, by the way, is the "paradise" the Muslim and the Mormon is looking forward to! Incredible! A place all his own, where he is the boss, where he sets the rules and where he calls the shots. A place filled with all the sensual pleasures—the good things of life forever. Unfortunately, man, man without The Good of God, will—absolutely will—experiment with evil. He will—absolutely will—turn his benign paradise into a convoluted, wicked, roaring hell. Fallen man totally denies this fact of life. It is THE lie told by the enemy of his soul.

Whenever a scientifically trained person tries to explain something to a theologically trained person, some interesting problems in communication develop. A scientist is used to using models to convey ideas. He knows the limits of models and unless it is his own model, and hence he has invested an excessive vanity in it, or unless he is merely immature, he does not try to learn overmuch from his model. It is a tool: a teaching tool, a memory tool, a conceptual tool. A religious doctrine is very like a scientific model. It is one's attempt to relate, and to describe, a collection of ideas. So far, so good. The mischief comes when we begin to invest in our doctrines properties they do not and should not possess. The whole becomes a great deal more than the sum of its parts. Both the theologian and the scientist would do well to remember the high value of excellent doctrine and of models, but the limitations of them, too. All of them are man-made things. All contain a little bit of the dung of the human condition. To deprecate others, or to persecute others because they do not accept our particular scheme of relating ideas, is akin to the use of force in making a conversion, perhaps impossible in the biblical sense. Worse, it demonstrates that we have left the scientific or religious arena and have decided to play in the political arena, and have determined to deceive ourselves and others that we have not moved.

We must remember that our quest is for truth—not for the domination of our particular view of "truth." For-

tunately, one of the names of Christ is Truth, and our quest for identification with Him can be total.

Thanks to you, Dr. Bube, for your long years of insightful works.

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Creationism & Ecology

Joseph K. Sheldon has provided a helpful survey of published books and articles on Christian ecological concern (41:3:152-158). However he makes a statement that is quite misleading and should not go unchallenged:

> The two papers by J.W. Klotz (1971, 1984), published in the *Creation Research Society Quarterly*, were important exceptions to the general lack of publications coming from the "young earth" press which has focused most of its attention on the time and method of creation (p. 157).

Readers may be led to think that is generally true of creationism. The fact is, the above publication CANNOT be taken as representative of creationist interest in ecological concerns for the simple reason that the purpose of the journal has to do with the study of *origins*. This does not mean that the creationists are not also interested in our Christian responsibility toward the planet. Creationist writings in THAT area will be found largely in OTHER publications. Incidentally, two creationist books NOT referred to are J.W. Klotz's *Ecology Crisis*, Concordia 1971, and Francis A. Schaeffer's *Pollution and the Death of Man: The Christian View of Ecology*, Tyndale, 1970. Dr. John Grebe, formerly Director of Nuclear and Basic Research for Dow Chemical was known for his concern for the environment way back in the pre-1950 period, long before it became a popular movement, and he sometimes got into hot water because of it! Dr. Grebe was one of the founders of the Creation Research Society, if I recall correctly.

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Animal Rights

A few points regarding Steven Scadding's review of *In Pity and In Anger*, by John Vyvyan (September 1989). Mr. Scadding criticizes Vyvyan for attempting "to create an emotional reaction against 20th century science based on a critique of the abuses of the 19th century." The blurb which accompanies review issues of *In Pity and In Anger* states that this "is the first of John Vyvyan's two books on this subject to describe the background and rise of the Anti-Vivisection Movement." Vyvyan's approach is historical. The second of his two volumes, *The Dark Face of Science*, continues the history of the antivivisection movement into the 1960s, and the picture is not better; in fact, it is grimmer. Mr. Scadding leaves the impression that 19th century vivisection was very bad, but that things have improved in the 20th century. England's use of experimental animals, which *In Pity and In Anger* chronicles, were several hundred a year, and the United States had scarcely begun to use animal experimentation by the 1870s and 1880s. England now uses several million animals a year, and the number of animals in the United States is estimated at 80 million a year. The experiments are not kinder. The technology for mutilating animals has advanced.

His statement that the Animal Rights movement is fragmented because animal rights people "lack a shared philosophy of the nature of animals and the nature of man," is also irrelevant. One doesn't require a philosophical position about the "nature of human beings" in order to criticize slavery. Arguments about "equality" or "shared biological impulses" may be diverting, but cruelty is really a simple matter. Everyone in the Animal Rights movement shares the conviction that cruelty to animals is abhorrent or they would not be in the movement. The Animal Rights movement is primarily a moral movement; not a political movement.

Nor is the Animal Rights movement "fragmented" more than other movements. Genuine movements are broadly based and contain multitudes. The movement is "diversified," and that is quite a different thing.

Mr. Scadding states that the relevance of Vyvyan's book "to the current animal welfare debate is questionable." Vyvyan's books are not about "animal welfare," which posits a different moral stance to the problem of animal cruelty. Vyvyan's books are about vivisection, not about the use of animals in zoos, circuses, or on farms. They are about vivisection as debased science, and that is the issue to which he addresses himself.

Finally, the reference to this publication as "subsidized" might lead a reader to believe that Micah Publications is a "vanity press." It is not. The use of the term "subsidized publication" is used for vanity presses in the United States.

Thank you.

Roberta Kalechofsky, Ph.D.
Editor, Micah Publications
255 Humphrey Street
Marblehead, MA 01945

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The locations of Indices for previous volumes are listed on the inside back cover of the Journal. Numbers in each entry refer to volume, issue, page number, month, and year. (For example—39:4, 190, D 1987—refers to volume 39, issue no. 4, page 190, December 1987.) The names in parentheses under the Book Reviews are the names of the book reviewers.

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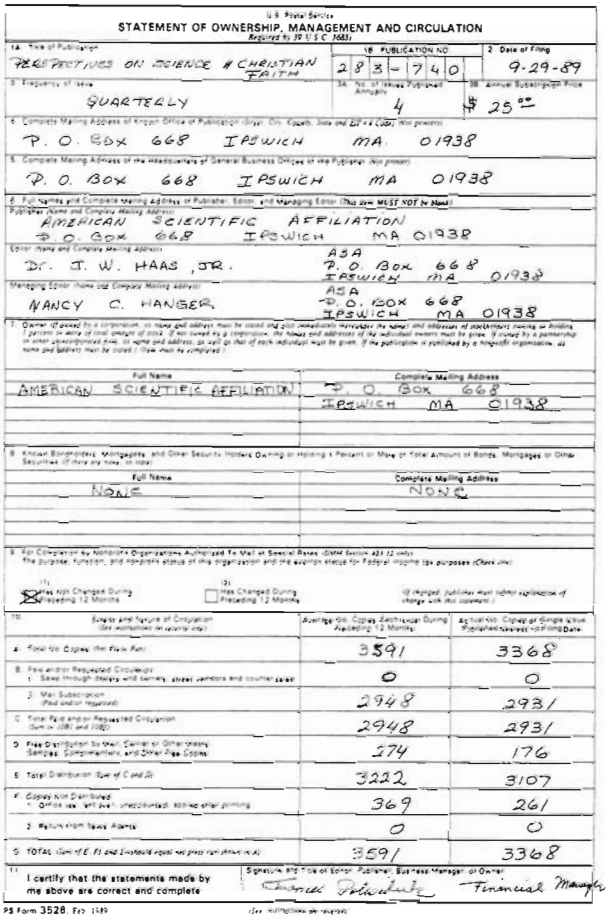

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may your ways be known on earth,
your salvation among all nations.

May the peoples praise you, O God;
may all the peoples praise you.
May the nations be glad and sing for joy,
for you rule the peoples justly
and guide the nations of the earth.
May the peoples praise you, O God;
may all the peoples praise you.

Then the land will yield its harvest,
and God, our God, will bless us.
God will bless us,
and all the ends of the earth will fear him.

—Psalm 67 (NIV)

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